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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI.

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EDITORIAL.

AT the opening of a recent meeting of the Legislative Council, His Excellency the Governor mentioned that " there was a time when the organization of life in Fiji was very simple and that Government was a negative business seeking only to guarantee to the citizen security in which to carry on personal undertakings. To-day that simplicity is rapidly passing away, " and thus must all officers of the Government be prepared for more complicated and far more intensive service and this indicates that progress is being made. His Excellency stated that he believed " in the future of Fiji and in the prospects of harmonious co-operation between the Fijian, the European and the Indian," and his optimism is pleasingly reasuring especially as we are undoubtedly living in a world of change.

The Department of Agriculture is endeavouring to assist agriculturists to meet changes (which are fast becoming obvious to those who mix with and know small agriculturists) and to instruct and guide them along sound lines.

For the Fijian, the most important crops are, of course, his food crops which he is primarily encouraged to plant and maintain in more sufficient quantities, and which he, in fact, does normally maintain of his own accord whenever he is permitted to do so.

Next to his food crops, the most important local crop which concerns Fijians is copra of which the export value last year was assessed at £404,000. The Fijians produce more than half the total output of the Colony and hence special efforts are in progress with a view to assisting them to improve their crops and their finished products and to plant more palms wherever conditions are suitable for this crop.

Since the July issue of the *Agricultural Journal* was printed the thirteenth Annual Show has been held and the various displays of fruit and vegetables and divisional exhibits brought home to the public some of the activities of the Department of Agriculture.

A visitor to the Colony of unusual importance was Sir Frank Stockdale, K.C.M.G., C.B.E., who is the Agricultural Adviser to the Secretary of State for the Colonies. His purpose in coming to Fiji was to report on agriculture and its practice in the Colony and the organization of the Department of Agriculture and his report on this subject will be awaited with interest. Sir Frank has had tropical experience in Barbados, Mauritius and Ceylon, being formerly Director of Agriculture in the last named Colony. Within the last few years he has paid official visits to India, the West Indies, East and West Africa, the Seychelles, Sudan, Egypt, Cyprus and Palestine and his reports on these countries are peculiarly informative. His visit to Fiji was most stimulating to officers of this Department.

The present *Journal* contains a very interesting article on soil erosion which is of a paramount importance to a country in the agricultural stage of development reached by Fiji. The marked difference between contour cultivation in the dry zone and its virtual absence in the wet is well brought out. The pernicious practice of shifting cultivation and its attendant results is stressed: with the example of parts of the United States as a warning it is incumbent that steps be taken here while there is yet time. The question of forest conservation in the highlands comes at a convenient time as the secondment of a Forestry Officer from Malaya has been approved by the Legislative Council.

The development and scope of the Imperial Agricultural Bureaux is dealt with in another article and gives some idea of what assistance is obtainable from such a unified organization which is sure to be utilised to the full by all the Colonies and Dependencies.

Under Veterinary notes, the success attained in the control of tuberculosis in dairy herds in the Suva District is traced and is highly creditable in that incidence of the disease was reduced in a period of four years from 18 per cent. to 0·4 per cent. of the cattle treated—20 herds being registered as free from disease. The extension of control of this disease is envisaged over the next five years but progress must necessarily be slow for financial reasons from the dairyman's point of view and because of limited staff from the Government aspect.

The symptoms of infection keratitis are briefly described and simple methods of treatment of the disease are indicated. The position regarding contagious abortion has so improved that it may now be said to be satisfactory; evidence indicates that innoculation with live vaccine has helped to control the disease.

Importers of pedigree cattle from Australia are requested to note that the embargo on such imports on account of ephemeral fever cannot yet be removed, but the situation is being watched by the Department. In addition simple treatments are given for dermatomycosis in dogs.

It is hoped that the Index for Volumes 5—8 will be found useful.

IMPERIAL AGRICULTURAL BUREAUX.

WITH the development of the Unified Colonial Agricultural, Veterinary and Forestry Services, development of Imperial Bureaux has also progressed materially in the past decade.

There is now an Imperial Bureaux dealing with each of the following subjects:—Agriculture, Forestry, Veterinary, Dairying, Parasitology, Mycology, Entomology, Plant Breeding (pastures), and Plant Breeding (other plants).

In the *Empire Cotton Growing Review*, Vol. XIV, No. 2, Sir David Chadwick, who is Secretary to the Executive Council of the Imperial Bureaux, gives a general summary of the work of these Bureaux and from his summary the following extracts may prove of interest:—

"The general term, "Imperial Bureaux," covers a group of agencies. Each deals with a specified subject or science. Each is located at a specially suitable research institute. Each is very similarly organized with very similar objectives, but each is developing to meet the chief demands of its clients. Yet all work in conjunction and all are under the one general control, the Executive Council of the Imperial Agricultural Bureaux. This Council is composed of

the nominees of the governments of the Empire who in mutually agreed proportions provide the funds for the work of the institutes and bureaux controlled by the Council. The organization is thus trebly co-operative. Each agency seeks to promote knowledge and co-operation among the scientists in the Empire engaged on its subject. The several agencies work in conjunction, not in competition. Taken as a whole they are a constitutional experiment in joint imperial administration.

The activites of the institutes and bureaux vary somewhat, but the chief an common purpose of them all is the collecting, indexing, abstracting of all information in the world as it becomes available in its own branch, and its distribution to the research workers in the Empire interested therein. For this purpose each institute or bureau publishes an abstracting journal which is placed on sale. Also, from time to time the bureaux issue special monographs. These are either reviews, with bibliographies attached, on the state of knowledge of some special subject at the time of issue, or descriptions of technique. In the years from 1930 to 1936 over 110 of these special publications have been issued, covering subjects such as soil erosion, vernalization, the arrangement of field experiments and the statistical interpretation of results, the technique of artificial insemination, vegetative propagation of tropical and sub-tropical fruits.

Each institute or bureau must take special pains to maintain contact with research institutes and workers everywhere in its own subject, and is organized to obtain and search all journals. But it is not a mere library service which is offered. The staff of each institute and bureau must necessarily be highly trained linguistically, but the officers at the head are in every case specialists in their own branch of science. The reason for locating the institutes and bureaux at well-known research institutes is to ensure that the officers of the bureau are in full current of their subject and meet and see specialists from other countries. Necessarily the articles abstracted are fewer than those indexed, but the close association of the bureau officers with active research workers everywhere, helps such selection as is needed. In the larger subjects the aid of specialists outside the bureau is enlisted in abstracting. In every case the work is supremely up to date and the object is to keep it "live."

Whilst the collection and dissemination of information is the chief of their services they have all repeatedly been asked for help in other directions: for translations, for introductions to other research workers, for aid in obtaining experimental material for information on technique and methods, &c. In the two older Institutes of Entomology and Mycology another form of service is a regular part of their duties. That is assistance in the indentification of specimens. Each of the Institutes has a small highly trained staff of specialists for this work; each has also obtained the co-operation of specialists elsewhere. The Institute of Entomology sends out on the average every day of the year a list to some entomologist in some Empire country giving him the names of insects which he has sent to the Institute for identification. On the average the insects so named exceed 8,300 a year, of which over 400 prove each year to be new to science. These applications for help come from every Dominion and every colony, and it will be readily understood that it is with the more difficult identifications that the aid of the Institute is sought. At the Mycological Institute similar aid is given to the mycologists in the Empire. A room is also maintained in which mycologists from overseas can come and work at their own problems.

The laboratory at Farnham House exists to help entomologists in obtaining parasites which they may require and cannot get locally, and also to aid them with information on this specialized subject. In the year 1936-37 over 20 million parasites have been shipped overseas through Farnham House. These have been collected from many parts of England, from Czechoslovakia from Hungary, from Scandinavia. In the current financial year a consignment has been despatched to some overseas Empire country on the average every other day. In the course of all its work much information of value and biological control has been collected, and one of the problems is to make that knowledge readily available.

The keynote of all this work, whether in the institutes or in the bureaux, is service to the research worker and to the scientist. It is not part of their functions to advise the farmer or the landowner. That is the duty of the national departments. When such requests are received, as they are from time to time, they are forwarded to the local department with or without additional information as the case may be."

SOIL EROSION.

By

H. W. JACK, M.B.E., B.A., D.Sc., M.L.C.,
Director of Agriculture and Conservator of Forests.

THE importance of problems of soil erosion and dessication in the Empire was recently stressed by Sir Frank Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, when he addressed an informal meeting in London of Forest Officers from all parts of the Colonies.

In his address Sir Frank first considered the problems from the physical aspects of climate, soil, steepness of slope and rainfall.

He pointed out that many soils eroded more rapidly than others, the rock-base possibly having an important influence on this character, and instanced the low liability to erosion of heavy calcareous soils in Jamaica compared with the rapid rate of erosion in soils derived from schists.

The steepness and aspect of slopes and the distribution of rainfall were other important factors affecting rate of erosion. In areas subject to a long period of drought, erosion was intensified since soil-particles tended to dry out and become surrounded with a layer of air which retarded absorption of moisture and the wetting of the soil.

From the biological side he stated that the problem involved an understanding of vegetation and the reactions to the way in which land was used for purposes of agriculture and pasturage, man-made erosion being usually due to interference with the vegetative cover and was capable of material retardation and prevention by protection of streams and general methods of conserving water supplies in the soil.

Thirdly, he stressed the fact that the livelihood of the people is always of paramount importance, and that such customs as shifting cultivation, cannot be abruptly upset but that attacking the problem in such economic and social circumstances can be successful by gradually building up a continuous system of agriculture aiming at intensification of agricultural operations in place of the practice of extensive native methods. He stated that there were two methods of counteracting shifting cultivation such as is practised in Fiji. One way was by providing a good rapid growing cover when land was thrown out of cultivation, the other was by the adoption of animal husbandry and mixed farming as a means of maintaining fertility.

As regards Fiji, it may safely be stated that soil erosion has been taking place for a considerable time as is evidenced by the general flat topography of the low red hills, the fineness of the soil deposited in valleys and the greater fertility of such soils in comparison with the residual eroded materials.

Many of the so-called river flats in Fiji are not composed of true alluvium, but are a mixture of true alluvium and the fine soil from the neighbouring eroded low hills (*i.e.* colluvial soils). The fertility of these soils is due in no small measure to their admixture with the eroded surface materials. Many profiles examined in the course of soil survey studies suggest the complete erosion of the surface horizon and the infertility of several soils can be directly attributed to this cause.

Much erosion by water action is masked by the system of native agriculture which permits of rapid growth of secondary vegetation in eroded

areas; nevertheless, sheet-erosion is very prevalent particularly in soils overlying soapstone and volcanic tuffs.

In the neighbourhood of Suva the soapstone is covered in many cases by only a few inches of soil, and although this formation is fairly recent there are locations where from natural causes erosion has been prevented and several feet of residual soil exists in association with the parent material.

In the Kalabo area the erosion of two feet of soil in the course of five years has been recorded. Again at the Experimental Station, Nasinu, particularly shortly after clearing, it is possible to witness sheet erosion and in small depressions the sandy clay soil type is mechanically separated, the fine silt and clay being washed away and the coarse and fine sand left to tell the tale. Chinese market gardeners are cultivating garden food-crops on an extensive scale at various sites along the Prince's Road, most of the cultivation being on sloping lands and, in the normal Chinese manner, clean weeding forms a feature of their agricultural routine. Erosion is extensive in certain locations in this area, and Chinese market gardeners have been known to build up soil in eroded locations, without making any provision for its subsequent retention.

In general, it can be stated for Fiji that wherever land is cleared of timber and subsequently cleared for cultivation, sheet erosion takes place in the undulating country and its severity depends upon the type of crops grown, the slope of the country, the soil type, system of cultivation and soil management, while in the steeper country cleared of forest, gully erosion is prevalent.

Practically all the alluvial flat country of Fiji is under cultivation or pasturage and apart from flooding there is little damage caused by erosion of these soils, since, as a rule they are very fertile and are mostly managed by the Colonial Sugar Refining Company whose methods of liming, green manuring and crop growth give rapid results. Where they are left to fallow, these soils are soon covered by a thick mat of sensitive plant, and Para and other introduced grasses. Organic colloids are high in these soils and owing to the binding nature of the organic constituents, they thus resist erosion to a great extent. Erosion through overstocking of flat pastures is almost absent in Fiji but on the slopes of the hills erosion is more noticeable, particularly where no provision has been made to retain the soils.

Many of the soils of Fiji—due to absence of organic colloids and their peculiar mechanical composition, a high content of fine silt and fine sand—are very easily eroded. These soils, if cultivated, expand and contract during wetting and drying, forming in some cases a patterned surface, and in others deep and extensive cracks. Where cracks are extensive in soils overlying soapstone, the percolation of water to the slippery soapstone surface has the effect of moving soil *en masse* on the sloping surfaces. The extent of this movement is controlled by the mechanical composition of the soil, the depth to which cracks extend, the amount of cultivation and the slope of the land.

In the dry zones of the Colony, contour cultivation of the hilly lands is frequently seen but in the wet zones Indians tend to plough up and down hill in order, it is stated, to facilitate drainage and in consequence much erosion takes place and frequently results in the flooding of roads in rainy weather.

Outside the sugar cane areas the system of agriculture adopted by the Indian peasant is to till the soil, plant one crop and to continue with that

crop until the soil is exhausted or the crop succumbs to disease. He then moves on to another selected area and continues the same wasteful practice. The exhausted areas are then abandoned and apart from the fact that no provision is made during cultivation to conserve soil, the exhausted condition of the soils after abandonment, is such in many cases as not even to permit of a quick return to natural conditions as instanced in the Kalabo area near Suva.

The Fijian shifts his cultivation at frequent intervals and although this practice is wasteful it has the merit that soils are not exhausted and usually revert fairly rapidly to natural conditions. Also, the Fijian very rarely clean-cultivates his land and some of his methods definitely tend to counteract erosion of the soil. Thus, in soils subject to sheet erosion the native method of disturbing only the soil in the immediate vicinity of the planting hole causes little erosion compared with the Indian method of entire tillage of sloping areas.

The Department of Agriculture through its Field Agricultural Officers and Demonstration areas, is attempting to teach the native a sounder system of agriculture, based on soil management and crop rotation. By this means it is hoped in time to limit his agricultural effort to a definite area which he will farm according to the advice and under the supervision of the agricultural Officers who have, in certain areas, demonstrated the conservation of soils on hillsides by contour cultivation, terracing, liming, green manuring and cover cropping.

The serious nature of soil erosion in Fiji is not fully appreciated at the present time, but it may be pointed out that areas which have suffered extreme erosion are being abandoned; many of the eroded areas are close to roadways, waterways, and ports, and new land is being opened up in steeper areas and is thus more subject to erosion. The total available agricultural land is ample for the present population but with increasing population exhaustion of soil and soil loss through erosion will steadily become more serious factors in land settlement and hence, the gradual adoption of a soil conservation and restoration policy is indicated.

Amongst well known methods for counteracting soil erosion, mention may be made of contour terracing, contour tillage, strip cultivation, broad-base terracing, contour hedges, cover cropping, rotation cropping, contour planting of protective belts of trees, mechanical means (usually too expensive, except in highly populated areas) the maintenance of permanent cover (forest) on steep slopes, mountain and hill tops and reafforestation. These and other methods of conserving soil moisture lead to the growth of agricultural and cover crops which in turn conserve and bind the soils. Gully erosion is of common occurrence in Fiji and requires special methods of control including the provision of diversion channels to direct flood and stream water away from the gullies, the erection of brushwood and other inexpensive dams, and the planting of suitable trees on the slopes and bottoms of the gullies. Small gullies can also be filled by ploughing across the contours.

The agricultural education of all races is important as a factor in the gradual reduction of losses of soils and of soil fertility: instruction towards this end is already being given by the Department of Agriculture through its officers and by ocular demonstrations at various native agricultural centres where such work is still very much in its infancy.

The principal causes of our soil erosion are undoubtedly shifting cultivation, uncontrolled timber cutting, fire and to a much less extent, grazing. The general effect of these forces is already rendering much of our accessible land infertile and unremunerative and in consequence it is desirable that attention should be directed to the need for the proper use of our soils and our vegetation which combine to form the greatest asset of this Colony. The task of preparation is Herculean, but much can be done if the many persons concerned each endeavour to do their own little " bit " towards the reduction of erosion and thus endeavour to leave to their descendants a valuable inheritance of land on which fertility has been built up by wise and judicious means of cultivation and utilisation.

The problem of repairing the destruction of soil fertility resulting from erosion by water, wind and heat, is gravely exercising the minds of many nations to-day, particularly in Africa and North America where many millions of acres of rich fertile soils have been dissipated in the course of a few generations—even within the memory of living men.

Fiji is still fortunate in that loss of vegetation and erosion have not yet been extensive, thanks to sparse population, but enough damage has been done to indicate the need of watchfulness to stem its progress and of education to stimulate agriculturists to economise in their use of land. Also needed is a sound permanent system of farming leading to the establishment of a permanent native peasantry in contrast with the unsettled shifting cultivation which accompanies communal agriculture at present.

THE FIJIAN COPRA DRIER.

By
Dr. H. W. JACK, M.B.E., B.A., D.Sc., M.L.C., Director of Agriculture,
and
L. W. HARWOOD, H.D.A. (Hons.), Agricultural Officer, Islands.

WHILE it is well known that good sundrying conditions can produce the best of all grades of copra, it is not practicable in most coconut-producing areas of Fiji to place sufficient reliance on sundrying. Hence, where sundrying is practised it is wise to have available some means of artificial drying, should weather conditions prove treacherous and unsatisfactory for the purpose of sundrying.

Efforts to introduce to Fijians artificial methods of drying of copra are definitely meeting with a fair measure of success, since although it is barely twelve months since such methods were inaugurated, already over 100 small kilns are operating, each kiln being capable of turning out 12 to 20 tons per annum, assuming that at least one curing is made each week. Actually, Fijians do not make a curing as frequently as once a week.

European planters also are beginning to recognize the fact that sundrying under the unreliable conditions of Fiji is obsolete and that if Fiji is to keep up-to-date, recourse to kiln drying, at least to some extent, is essential.

The type of small drier which is specially designed for slow drying by the Fijians is capable of turning out first quality copra provided that the routine established for this type of kiln and made known to the Fijians by native assistants, wireless talks, and by pamphlets (in Fijian), is reasonably well followed.

The same type of drier is being used by Europeans in several areas, but Europeans endeavour to speed up the drying and use mostly timber fires, with, in many cases, undesirable effects, which result in badly scorched and even burnt copra, and often a badly smoked product.

Unfortunately Fijians have in several areas copied these unauthorised and undesirable methods with unsatisfactory results in consequence.

It was never the intention of the Department of Agriculture that these kilns should be introduced to estates as unit kilns though it was hoped that estates would operate them as batteries, but in either case it is necessary to follow the routine methods for which the kilns are designed.

Now that European planters in some areas have shown themselves to be keenly interested in the possibilities of the small holders' copra drier when operated in batteries, some notes on the small copra driers thus operated are given later in this article.

While fair progress has been made, there has not been an immediate increase of quality in the copra produced by these kilns as many snags have been encountered, but it must be remembered that when the " better copra campaign " was started, it was definitely stated that it was anticipated that at least two years would elapse before the Fijians would settle down to the new idea of kiln-dried copra and of drying their own copra.

In the case of a number of small kilns operated by Fijians, it is pleasing to note that good quality copra is already being produced and it is anticipated that with further instruction and more supervision by native agricultural assistants, that the numbers of Fijians who will regularly produce good copra will increase materially and rapidly.

In this matter, the rapidity of improvement can be greatly accelerated by the helpful co-operation of the copra buyers in insisting on a good product,

which can now be turned out by the native in many areas, provided that the buyers persist inp urchasing only good copra or in penalising in some degree sellers of bad quality copra.

Hence the Department of Agriculture is anxious that all buyers should assist in this matter for the general welfare of the Colony, and in particular for the welfare of the Fijian who is now beginning to think and act for himself.

Many of the Fijians are still paying insufficient attention to the routine of drying copra as laid down in issued instructions, and hence, producing poor and smoked copra, consequently in this article it is intended to point out their main shortcomings with the hope that improvements will continue to be made, and that interested Europeans will co-operate with the Department of Agriculture is passing on these general instructions, which will also be circulated in Fijian.

For the sake of emphasis the standard routine of drying with the standard sized small kilns (6ft. x 6ft. drying floor) as illustrated in the diagram (attached) may justifiably be repeated as follows:—

Collect and husk 1,500 to 1,600 ripe nuts. Two men with practice can readily do this work in one day.

First day. FINE WEATHER ROUTINE.

6 a.m.—Split the nuts, discard bad ones or those with a germination core in excess of 1½ inch in diameter, turn the half-nuts, meat side downwards on a clean, well-drained surface, to drain for two hours.

8 a.m.—Invert the drained half nuts and sundry for 4 to 6 hours (less if sun fails, longer if the sun is strong).

Noon.—Set and light a single row shell fire of about 160 half-shells (dry and clean of fibre) as indicated in diagram (the fire is started early so as to warm the kiln).

2 p.m.—Place the partially sun-dried nuts on the warmed kiln. Maintain the single row fire till 8 p.m.

8 p.m.—Turn over the nuts, set and light another single row shell fire and maintain.

First day. WET OR DULL WEATHER ROUTINE.

6 a.m.—As for fine weather routine.

8 a.m.—Set and light a single row shell fire (as at noon above, in fine weather routine). Place the drained half-nuts on the kiln and maintain the shell fire till noon.

Noon.—Turn over the half-nuts on the kiln, set and light another single row shell fire and maintain till 8 p.m.

8 p.m.—Turn over the nuts, set and light another single row shell fire and maintain.

Second day. ALL WEATHER ROUTINE.

6 a.m.—Turn over the nuts on the kiln, set and light and maintain a double row shell fire as in diagram III.

Noon.—Allow fire to die down, turn over the nuts on the kiln, set and light another double row shell fire and maintain till midnight.

Third day.

6 a.m.—Turn over the nuts, set and light a single row shell fire, maintain till noon.

Noon.—Turn over the nuts, pick out any loose shells, set and light another single row shell fire and maintain till midnight.

Fourth day.

6 a.m.—Turn over the nuts on the kiln, pick out any loose shells, set and light a single row shell fire till noon.

Noon.—Turn over the nuts, set and light another single row shell fire and maintain till evening.

Fifth day.—Remove the copra, separating it from all shells.

The copra if properly dry should break under pressure with a sharp snap and reveal an even pearly surface. It should be piled loosely in a dry place and turned over daily for a few days before bagging. If convenient it may be placed in warm shunshine with advantage for a day or so before bagging.

DEFECTS IN THE QUALITY OF THE COPRA.

Insufficient drainage before drying.

As a result of careful investigations into the reasons for reported defects in the quality of the kiln dried copra, it has become apparent that insufficient drainage has been given to the split nuts in many cases.

It is of the utmost importance that the split nuts should drain for not less than two hours prior to sundrying or placing the nuts in the kiln (according to the weather).

Insufficient drainage results in discoloured copra, whereas bad nuts are eliminated at the start, careful draining followed by kiln drying should result in 85 per cent white copra, while if two hours drainage is followed by 4 to 6 hours sundrying before kiln drying, about 95 per cent. of white copra should be possible. There will always be a few discoloured nuts due to constitutional defects in a few palms.

Delay between splitting, drainage, and sun or kiln drying.

All such delays tend to increase the percentage of discoloured copra.

Two hours delay results in over 20 per cent. discoloured copra; five hours delay in about 30 per cent.; ten hours delay in about 40 per cent. and fifteen hours delay in almost 50 per cent. of discoloured copra.

All such delays must be avoided if a good quality product is to be obtained.

Overloading the kilns.

If more than 1,500 partially sundried or more than 1,200 drained but not partially sundried nuts, are placed as one charge on these small kilns, the copra is liable to become pitted and slightly scorched or discoloured, the percentage affected depending largely on the numbers in excess of the figures above quoted.

This result is explained by the fact that the hot moisture-laden air, on passing up through the deep bed of drying copra, tends to deposit some of its moisture on the cool upper layers of half nuts by condensation.

In these cool upper layers instead of drying, bacterial action is developed and the copra becomes pitted and slimy.

The lower layers on the other hand dry too quickly and tend to become scorched and case-hardened whilst the impeded ventilation causes the fire to burn unsteadily and to produce excessive smoke.

Thus, it is very important to follow the correct loading authorised for the size of the kiln.

Insufficient drying.

In endeavours to speed up the curing process it frequently happens that copra which is insufficiently dry or not all dry, is produced. Should more rapid drying be required it is necessary to reduce the load on the copra

platform, by about half, as then the required amount of moisture can be driven off in a proportionately shorter time by the standard firing, which is designed to dry 1,500 nuts in 3 or 4 days.

It is of value to mention that in Ceylon and Malaya large estates maintain an average drying routine covering four full days, which practically eliminates scorching, burning, pitting, discolouration, and under drying. Many of the estates in those countries use the same principle of drying as that employed in the standard small kiln now advocated in this Colony for Fijians and other small holders.

On large estates such kilns are worked in batteries of four or more under one roof. A diagram and brief description of such a battery may be found below.

Scorching and Smoking.

These defects are those most commonly experienced in kiln dried copra and may be caused by—

(*a*) overloading the kiln.

(*b*) insufficient drainage of the split nuts;

(*c*) insufficient or incorrect ventilation in the firepit or more often in the covering building (bure). The bure should be given ample top ventilation to permit the rapid escape of moisture-laden hot air and it has been found that a bure built and roofed with plaited coconut or sago leaves gives better results than an ordinary Fijian bure, and is cheaper to erect;

In the use of either type of building ample ventilators should be provided and care should be taken that the half shells are dry and moderately clean of fibre;

(*d*) it is essential that the baffle-plate should hang evenly as an unevenly suspended baffle-plate will result in scorching, uneven and insufficient curing, and in some cases, burning;

(*e*) scorching may also be caused by dirty baffle-plates and it is advisable to see that the baffle-plates are clean prior to each charging of the kiln;

(*f*) failure to turn over the nuts according to routine or at least once daily may cause scorching;

(*g*) smoking may also be caused by the half shells being jammed too tightly together in the fire pit.

In addition, it may be noted that copra which has been insufficiently drained will tend to become more smoky and more scorched than well drained or presundried meat.

Burning.

Serious scorching and burning have been noticed in some cases and can usually be traced to overloading or overfiring, but Fijian copra produced in the small kilns show less burning on the average than copra dried on some estates using various types of driers or with timber fuel, as judged by a recent tour of Vanua Levu and Taveuni.

If the routine for small kilns is reasonably well followed burning, should never occur though slight scorching may owing to the omission of turning the copra at least once daily during curing, especially on the second day.

Badly germinated nuts however tend to become scorched or burned and hence should not be included with the kiln dried copra.

Excessive Free Fatty Acids.

This is almost entirely absent in copra produced in the small kilns by Fijians.

A recent examination of twelve samples selected at random from twelve kilns in various parts of the group, operated with and without departmental supervision showed a percentage of free fatty acid varying from 0·08 per cent. to 0·35 per cent. which is extremely good as compared with the average for South Seas copra which stands at around 6 per cent. to 8 per cent. or even higher.

In the few cases where free fatty acid was noticeable it was invariably due to neglect in the continuity of curing or in long delay between splitting the nuts or cutting out the meat or due to the purchase of " green " copra.

All these causes of this defect will tend to diminish as the Fijian becomes more an individualist and works for himself instead of working for a community in which he has only a small share of interest.

FIJIAN COPRA DRIER FOR ESTATES.

In response to numerous enquiries from interested planters, a short description of the Small Copra Kilns, when operated as batteries of four or more kilns, has been prepared.

The small copra kilna, with a capacity of 12–20 tons per annum, is designed primarily for the use of small-holders. Some European planters have endeavoured to utilise the small-holders' kilns as unit kilns on their estates but have found that these kilns are of insufficient capacity for estate requirements.

However, combinations of kilns of this type are operating on many big estates in the East, where four-day drying is the rule rather than the exception —often drying extends to five days.

Before explaining the diagram and the method of operating the kiln battery, it may be mentioned that a battery kiln of four compartments, each of 6ft. x 6ft. drying floor, working every day, would produce a maximum of 90 tons of copra per annum, while a battery of four compartments with 10ft. x 8ft. drying floors could turn out double that quantity.

It may be mentioned that only one man would be required to attend to the splitting and draining of the nuts, firing, curing and handling of the copra after the husking which would be performed in the field by other workers.

The battery (see diagram) consists of one row of four kilns placed in line under a single roof. The dimensions of the small Fijian copra kilns are 8ft. x 8ft. on the ground and 6ft. x 6ft. on the drying floor. In the smallest battery the same area of drying space has been retained, but to simplify the working of the kilns and to avoid excessive handling the dimensions on the ground have been altered. The larger size of battery kiln would follow the same structural design as the small battery kiln.

In the small battery kiln compartments B and C in the middle are 6ft. x 6ft. ground measurements, but compartments A and D at the ends are 8 feet. long and 6 feet wide.

In these combination kilns the outside walls at the end of the battery are sloping inwards but the remaining walls are vertical.

One single wall suffices to separate the various compartments so that three intermediate walls will be sufficient for the 4-battery kiln. The battery kiln may be constructed of sawn or rough bush timber or bricks or cemented rocks or other readily available materials.

Each compartment of the kiln is independently fired and operated and each compartment is constructed according to the principles standardised by the Department for small Fijian kilns in every detail.

Each compartment of the kiln being independently fired, must be provided with a small door.

The operation and curing routine of the small battery kiln is exactly the same as that recommended for the single unit kilns but it should be noted:

that Compartment A always holds the nuts for 1st day of curing.

do.	B	do.	2nd	do.
do.	C	do.	3rd	do.
do.	D	do.	4th	do.

The routine as described earlier in this article, for small individual kilns, should be followed carefully with the battery kiln, but for convenience is repeated below.

Monday. FINE WEATHER.

6 a.m.—Split 1,500 nuts, eliminate bad ones. Drain for 2 hours.
8 a.m.—Sun dry for 4–6 hours, longer if sunshine is strong.
12 a.m.—Warm up compartment A.
2 p.m.—Place the partially sundried nuts in compartment A and maintain single row shell fire until 6 a.m. Tuesday morning, turn over copra once during the day (say 8 p.m.).

Monday. WET WEATHER (as alternative to fine weather on the starting day).
6 a.m.—Split 1,200 nuts, warm up kiln A. Drain for 2 full hours.
8 a.m.—Place nuts in compartment A. Maintain single row shell fire until 6 a.m. Tuesday. Turn over copra once during the day (say noon) or better twice (at noon and 8 p.m.).

Tuesday.
6 a.m.—Transfer the half nuts from compartment A to compartment B. Maintain double row shell fire in compartment B. and turn the nuts over at noon. Refill compartment A with freshly split and drained half nuts after partial sundrying (if possible). Maintain single row shell fire in compartment A.

Wednesday.
6 a.m.—Transfer half nuts from compartment B to compartment C. Maintain single row shell fire in compartment C. Transfer half nuts from compartment A to compartment B. Maintain double row shell fire in compartment B and turn the nuts over at noon. Refill compartment A with fresh half nuts as before. Maintain single row shell fire in compartment A.

Thursday.
6 a.m.—Transfer half nuts from compartment C to compartment D. Maintain single row shell fire in compartment D. Transfer half nuts from compartment B to compartment C and maintain single row shell fire in compartment C. Transfer half nuts from compartment A to compartment B. Maintain double row shell fire in compartment B, and turn over the nuts at noon. Refill compartment A as before. Maintain single row shell fire in compartment A.

Friday.

6 a.m.—The copra in compartment D will be cured and should be removed, the shells being picked out carefully.

The process may be continued daily as shown in the above routine. During the transfer of nuts from compartment B to C or from compartment C to D, any loose shells should be removed from the kiln and while transferring the nuts from compartment to compartment the fire should be extinguished.

The dimensions of these battery kilns can be increased, if desired, to suit individual requirements of estates. Thus, increasing the copra platforms to 6ft. x 8ft. would increase the out-turn by about 25 per cent.; that is, about 2,000 drained presundried nuts or 1,600 drained (only) nuts. With a copra platform 10ft. x 8ft. the capacity would be increased to about 180 tons per annum at full capacity, but for this size the routine of firing would require to be altered as follows:—

(Compartment A.—Always two single row shell fires burning from opposite ends and placed in straight lines 2½ feet apart.

Compartment B.—Always 1 double row and 1 single row shell fire burning from opposite ends and placed as in A, alternating the position of the double and single shell fires as they burn out.

Compartment C.—Always 2 single row shell fires as in A.

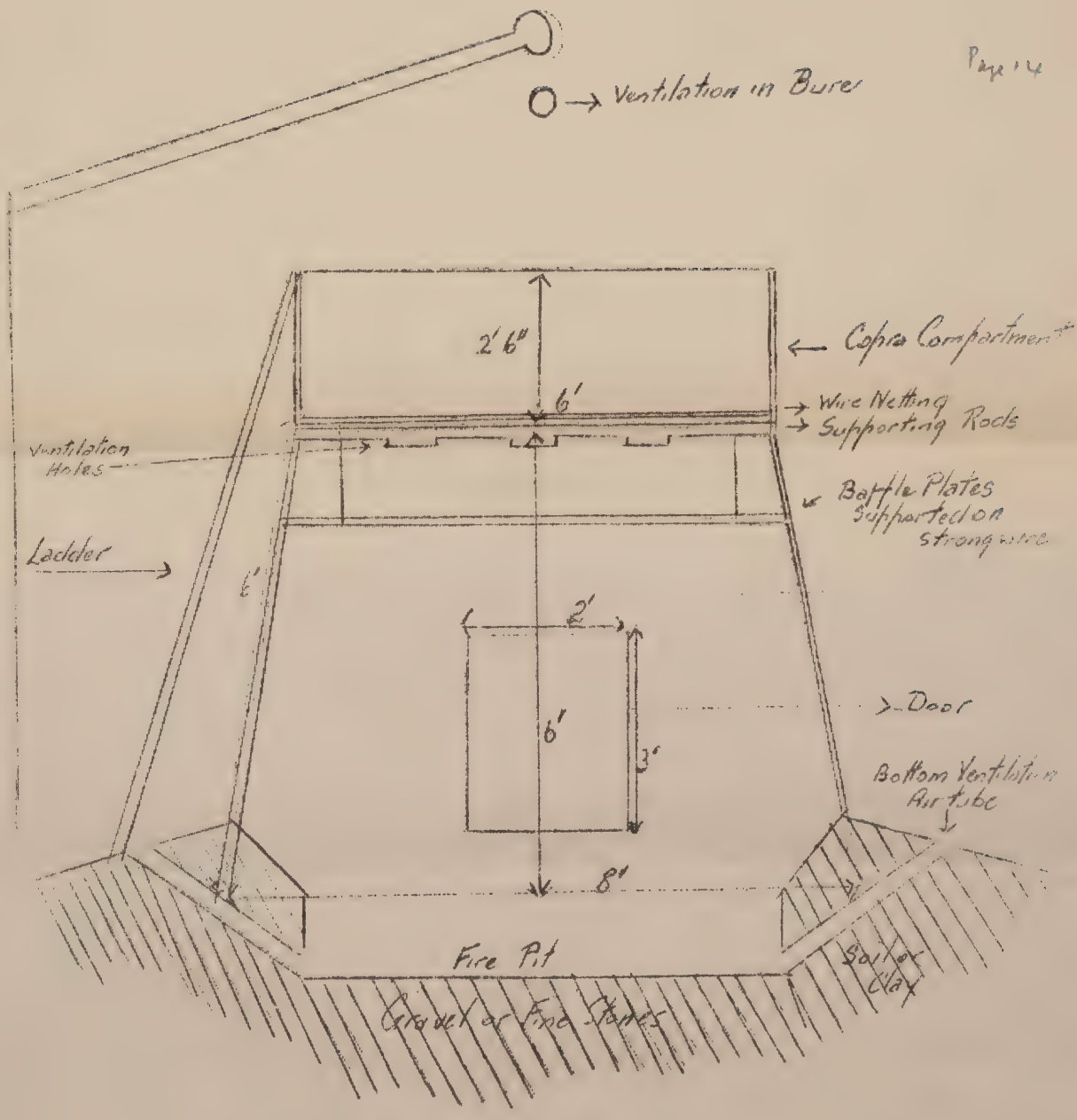
Compartment D.—Always as in C.

For large estates, it is advisable to erect a battery kiln in each 300–400 acre block of the estate in order to reduce transport costs. Husking should of course be done in the field so that the husks can be retained on the land as manure and mulched round the palms. Splitting and drainage of the nuts is best performed at the kiln, so that time should not be lost in carrying out the general routine of drying since, as already explained, such delays are detrimental to the production of good quality copra.

Further information and advice will always be available on enquiry at the Department of Agriculture or from any of the Agricultural Officers stationed in the Districts.

GENERAL PRECAUTIONS.

1. Be sure to drain for two full hours after husking and splitting.
2. Be sure the baffle plates are clean before lighting fires.
3. Be sure your shell fuel is clean, dry and of uniform size.
4. Be sure you do not over-load your kiln.
5. Be sure to sundry on first day whenever possible.
6. Be sure your fires do not smoke much, they will not if they are burning properly.
7. Be sure you turn over your nuts in compartment B daily at noon, preferably twice daily and at least once daily for all other compartments.
8. Be sure you pile copra loosely and turn over daily for a few days before bagging.
9. Be sure you remove all shells before bagging.
10. Be sure you ram your bags well, the copra may be chopped into quarters, if desirable.



Small Copra Drier

Diagram I

Arrangement of half shells for first day's firing

Diagram II

Arrangement of half shells in kilns operated as batteries

1st Day

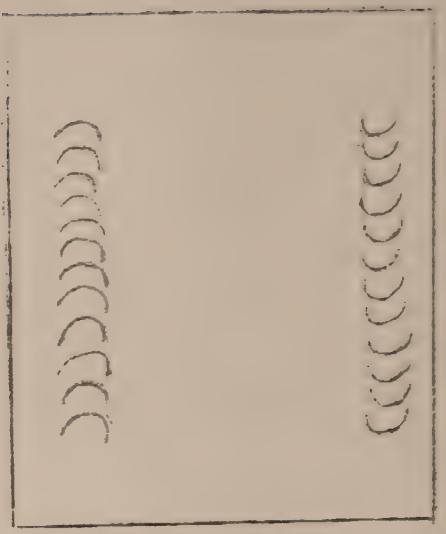


Diagram IV

Arrangement of half shells for second day's firing

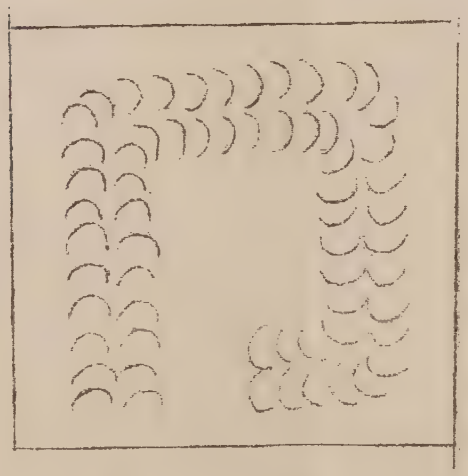
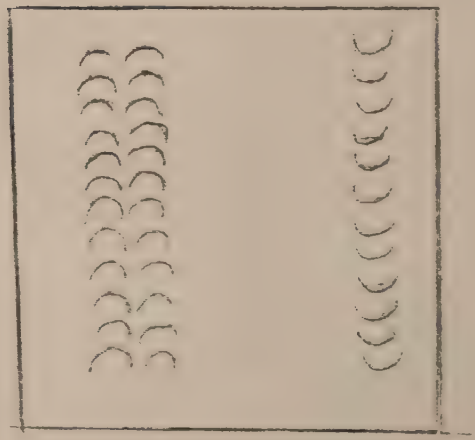


Diagram III

Arrangement of half shells in kilns operated as batteries

End day



TREES ORNAMENTAL AND USEFUL.

By
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THE use of trees for ornamental purposes is a feature of town planning and roadside planting in many countries, while few demesnes, public parks, gardens and open spaces exist without a background of trees, thus indicating that the value of a tree is not necessarily to be found in the amount of timber it will produce. Visitors to England and France are attracted by the planting of the Plane tree (*Platanus orientalis*) in the streets, public squares and market places of many cities and towns; in Germany many public roads are planted with fruit trees which give wonderful displays of flowers in the springtime and colourful fruit in the autumn; in Switzerland the Horse Chestnut (*Aesculus Hippocastanum*) is largely used to provide floral displays in spring and welcome shade in summer at the lake-side tourist resorts; in Egypt the Flamboyante (*Poinciana regia*) and in Australia the Gum trees (*Eucalyptus* spp.) are utilised, probably one of the best examples being the famous St. Kilda drive, the "Champs Elysées" of Melbourne.

In Fiji little of such planting has been done, the two outstanding examples being the use of the Weeping Fig tree (*Ficus Benjamina* or *Cunninghamii*) on the water front of Suva, and the Rain tree (*Pithecolobium Saman*) on the road between Lautoka and Natabua. Since 1934 many plantings of other trees have been made along the new King's Road and elsewhere but these have not had time to demonstrate their ornamental value, while the few reservations of natural "bush" made by Government along the King's Road and some portions of the Queen's Road demonstrate the value of mixtures of sundry trees, shrubs &c., in a natural setting for ornamental purposes.

There are, in Fiji, a number of indigenous as well as exotic trees &c., suitable for ornamental purposes, many proving of economic value also, and a list of some such trees is given below together with notes which may prove of general interest and encourage the use of such trees more freely for decorative purposes.

Dealing first with the indigenous trees, by their vernacular names, mention may be made of the following:—

(1) The "Baka"—*Ficus obliqua*, S. A familiar tree as an epiphyte, commonly on the Ivi (*Inocarpus edulis*) which it ultimately destroys by its stranglehold. A windblown specimen of fantastic shape is to be seen near the present Suva Golf Club house, the host having been destroyed. The Baka when grown as a specimen tree develops into a large spreading light shade tree, the small, dark well-spaced green leaves being very attractive, particularly at seeding time when the small red berries appear at the axils of the leaves. An excellent specimen is to be seen near the late Ratu Popi's food garden at Natila, Tailevu Province.

(2) "Cau," "caukuro," "velau"—*Casuarina nodiflora*. A tree common in the bush near Suva, favouring the wet zone as against the dry zone, the latter being preferred by the "nokonoko"—C. *equisetifolia*. As a young tree, the velau, with its bright green needle-like leaves supported on brown limbs, is very attractive, suggesting the European Xmas tree, while as a mature tree, the branches from the main stem suggest a giant candelabra with the "candles" surmounted by dark green dome-shaped hoods. It produces good firewood and makes exceellent fencing posts.

(3) The "Balabala" or tree fern—*Alsophila lunulata*, is a popular feature of the native bush, particularly in the wet zone near gullies and water-

courses. Its growth is vigorous and attractive and makes it a useful ornamental plant when arranged in clumps in places where shady, moist conditions prevail, sheltered from the strong trade winds. Such clumps would beautify many a difficult corner and provide excellent shade for ferns, caladiums, gloxinias, &c. The use of the basal part of the trunk for fern and flower pots is well known and utilised; when split lengthwise, they make excellent non-slip steps.

(4) "Dakua" or Fiji Kauri—*Agathis vitiensis*. A tall stately tree, probably the handsomest tree of Fiji, having a straight smooth stem, carrying a dense head of dark green foliage. It is a slow-growing tree of particular interest in that the seedling, up to about two years of age, carries the typical needle-like coniferous leaf, after which the leaf changes to the broad leaf of the adult tree. Several good specimens are to be seen at the roadside of the Queen's Road between Suva and Navua, but it flourishes best in the hills above 1,500 feet where specimens up to 40 feet in girth may be seen. It produces excellent timber and the famous "kauri" gum.

(5) "Dakua salusalu"—*Podocarpus vitiensis*. A large, erect, handsome tree, carrying small bipinnate leaves, particularly ornamental in the young state. It is fairly common in the bush on the Queen's Road, in the neighbourhood of Mau. The light foliage of the young plants is very attractive, but the tree requires care in transplanting. It produces a very useful soft timber and makes good firewood.

(6) "Dawa"—*Pometia pinnata*. A tall, hansome tree, the new foliage of which is almost blood-red in colour, giving the tree a rather striking appearance. It produces an edible fruit, favoured amongst the Fijians.

(7) "Drala," "Coral Tree"—*Erythrina indica*. A medium-sized quick growing, deciduous tree, which in the dry season—about August—carries clusters of scarlet flowers at the tips of the branches, when bare of leaves, and presents a striking appearance. Other varieties of *Erythrina* are present in the islands, one, a shrub, however, is not so prolific a flower producer as *Erythrina indica*, while the other is favoured for its foliage, having large trifoliate and variegated leaves (*E. variegata*). It is easily propagated by cuttings. Specimens can usually be seen in most Fijian villages and there is one good specimen near the Nasinu stone-crusher.

(8) "Ivi" or "Tahiti Chestnut"—*Inocarpus edulis*. A very familiar tree in Fiji and appreciated for its upright habit, dense, dark green foliage, sweet-scented flowers and fruit—a large nut. It thrives in low-lying places, by the side of creeks and any place that is reasonably moist. It is readily propagated from seed. An excellent specimen may be seen in the Triangle, Suva.

(9) "Kavika"—*Eugenia malaccensis*. A medium to large-sized tree which produces in great profusion crimson to purple flowers along the branches, the stamens of which form a brilliant carpet under the trees as they drop. The fruit is small, loaf-shaped, very juicy but flavourless and carries a large seed.

(10) "Makita"—*Parinarium laurinum*. A medium-sized upright tree with dense, dark green foliage. Produces a nut, the oil of which is used by the Fijian for caulking their canoes, while the foliage makes an excellent thatch for their houses.

(11) "Sa," "saca"—*Parinarium insularum*. A tall tree of upright habit, carrying attractive dark green foliage. Is particularly pleasing when new growth appears, such foliage being of yellowish brown in colour. The timber gives excellent firewood. Good specimens are to be seen at the Nasinu Experimental Station.

(12) " Uto " or Breadfruit—*Artocarpus incisa*. A most hansome broad-leafed tree, familiar to all in these islands, is a fairly quick grower and produces at the ends of the branches one or more large round or ovoid fruits, greenish-yellow in colour. Some varieties carry seed. Propagated by suckers, cuttings and seed.

(13) " Vesi "—*Intsia bijuga*, S. A medium to large sized spreading tree, usually found near water and propagated by seed. It gives excellent shade, fairly dense foliage, bears small purplish-coloured racemes of flowers and produces good timber.

(14) " Vuga "—*Metrosideros polymorpha*. A very handsome foliage tree carrying small dark green and shiny leaves, new growth being a light yellowish green in colour. It is a beautiful sight at flowering time when the exterior of the tree is covered with small scarlet flowers. Good specimen trees may be seen at Colo-i-Suva and generally on the hills.

(15) " Vutu "—*Barringtonia speciosa*. A medium-sized spreading tree with handsome foliage of large shiny dark green leaves. It is particularly suitable for coastal situations where it produces large white pin-cushion flowers, which consist mainly of long white stamens sometimes tinged with pink, followed by a large quadrangular one-seeded fruit. An excellent specimen is to be seen near the Cable Office, Suva.

The following brief list deals with exotic species which have been successfully introduced over a period of years and have proved suitable for local conditions.

(16) Queensland umbrella tree—*Brassaia actinophylla*. A handsome, sparsely branched, evergreen tree, growing about 40 feet high with very large radially divided leaves. The tree is remarkable not only for its foliage but also for the terminal inflorescence which consists of sereval radial spikes of crimson flowers, a great attraction for the native " Kula," or parakeet. It is propagated by seed and suckers. Excellent specimens are to be seen at the Nasinu Experimental Station near Suva.

(17) Rose of Venezuela—*Brownia grandiceps*. As the name implies, this is a native of Venezuela. It is a small tree about 30 feet high, with pinnate drooping leaves which, when young, form flaccid, light brown coloured bundles. A very beautiful tree when in bloom, which at the Nasinu Experimental Station occurs two or three times in a year, the flowers occurring in brick-red clusters along the branches and are sweetly scented. It is propagation by seed.

(18) *Cassias*.—These form a comparatively large and distinguished family:—

Cassia grandis—Horse cassia—is distinguished by being deciduous, the pink flowers being produced after the shedding of the leaves and before the new foliage appears. If produces viable seed in Fiji.

Cassia nodosa or the pink shower is a more spectacular flowering tree than *Cassia grandis*, the large clusters of apple-blossom pink flowers produced along the branches amongst the foliage being a very beautiful sight. The flowering season is approximately from November to February. The tree does not produce seed in the wet zone but some small success has been achieved with cuttings.

Cassia fistula, the Indian Laburnum or golden shower, is another very beautiful Cassia, usually flowering twice a year. A small tree, usually well-shaped and when in flower—from October onwards—is covered with drooping racemes of golden yellow flowers suggestive of the European Laburnum. It does not seed at Nasinu and propagation is by root suckers.

Cassia siamea, Cassia mulijuga are two large trees carrying yellow flowers but not so spectacular as *Cassia fistula*, the former non-seeding, the latter seeding freely.

(19) *Coffea liberica.* A small tree with rather large dark green leaves, usually conical in form under open conditions. Its foliage makes it a useful ornamental tree particularly when in bearing, first the small white flowers along the braches, followed by the red berries enclosing the seed. It is both ornamental and useful and is propagated by seed.

(20) Eucalyptus. Several varieties of *Eucalyptus* have been introduced, which after establishment, become fast growers, the trunks and foliage being attractive. *Eucalyptus citriodera* has the additional attraction of being a great favourite at blossom time with the Fijian "Kula" or parakeet.

(21) Flamboyante—*Poinciana regia.* The "flame-tree" of the tropics. a beautiful large spreading tree with feather deciduous foliage. It provides a magnificent sight when in full bloom, the canopy of scarlet flowers overlying the foliage making the tree a most striking object. A beautiful specimen occurs near the Fire Station, Suva. It is propagated by seed.

(22) *Lagerstrœmia Flos-reginæ*—Pride of India. A medium to large sized spreading tree, deciduous. The foliage tends to take on autumnal tints. It flowers from December onwards when the tree presents a remarkable sight with its masses of mauve-purple flowers at the ends of the branches. Excellent specimens occur in Government House Grounds, at Nasinu and on and near the Government Station at Naduruloulou.

(23 The Rain Tree—*Pithecolobium Saman.* Two or three varieties of so-called rain trees occur, of which the one named above is probably the most common. It is a large handsome spreading tree, very quick growing and commonly planted for shade purposes at roadsides, open spaces, &c. The best example of roadside planting has already been referred to, namely on the road from Lautoka to Natabua, while as a single specimen the rain tree on the "rara" at Bau Islands is worth noting. Propagation is by seed.

(24 Tulip tree—*Spathodea campanulata.* A tall, erect, quick-growing soft wood tree, with dense foliage. The large scarlet cup-shaped flowers which somewhat resemble the tulip, are carried at the ends of the branches, and when protection is given from strong winds, they occur more evenly over the tree, which provides a striking object when in full bloom. It is propagated from seed or cutting. Excellent specimens occur near the Government Buildings, and in the Department of Agriculture grounds, Suva.

From the foregoing a selection of one or more ornamental trees can be made which will add charm and dignity to the average garden, park, open space or roadside where such is required; further efforts by the Department of Agriculture are in progress to render available constant supplies of planting materials to cope with the horticultural needs of the Colony.

FIJI KAURI—RANDOM NOTES ON TREES OF FIJI.

By

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Manager, Fiji Kauri and Timber Company.

Fiji is blessed with a luxuriant vegetation: Nature, in beneficient mood, has indeed provided the forests with many beautiful and valuable timbers. That these timbers have for so long been held in poor regard is attributable to injudicious and wrongful usage rather than to inherent defect or inferiority of quality.

Outstanding among the many varieties of useful commercial timbers is the Kauri and nowhere will more magnificent specimens be found. Known to the native as Dakua Makandre, and to the botanist by the equally formidable but less euphonious title of *Agathis vitiensis*, the Kauri must indeed rank as the most venerable monarch of the local forest.

The timber of the Fijian Kauri is strong and durable, often beautifully grained and varying from the palest of yellow to light amber-brown in colour.

In close proximity grows its ally, the Dakua Salusalu, *Podocarpus vitiensis*, which is of more delicate growth and whose timber when properly dressed reveals a delightful tracery of grain and a finish of almost satiny perfection.

Freely interspersed throughout the forest, may be found the Damanu (*Calophyllum* spp.) or Island Mahogany, rich red in colour but difficult to work; the Kauvula (*Endospermum*) white and clean of texture but of disappointing durability though useful for export fruit packing-cases, and hardwoods like the Buabua (*Guettarda speciosa*), the Vesi (*Intsia bijuga*), the Yasi (*Santalum yasi*), Vuga (*Metrosideros* sp.), the incomparable but rarer Rosawa (*Vitex vitiensis*) and many others, though there are none that serve the every-day demand of man as do the Kauri and Salusalu.

In popular opinion, not only is New Zealand regarded as the home of the Kauri but also as the one country wherein that tree, by virtue of some mysterious susceptibility, can attain to perfection: other countries and climates may perforce produce a hybrid of lesser breed and status—but decidedly not New Zealand Kauri.

Actually, of course, the Kauri tree has a wide distribution and is found in the Straits Settlements, Borneo, Santa Cruz near the Solomon Islands, New Caledonia, New Zealand, Queensland, Fiji and the New Hebrides, so that this tree owes allegiance to no one country or climate.

Certain it is that trees, like denizens of the animal kingdom, are not only influenced but have certain characteristics defined, even modified and varied, by their environment. Thus, Kauri trees rising to maturity in warm temperate climes, growing on not too exposed hill tops, attain a strength, size and durability not found in their kindred, reared and nurtured under easier and less enervating conditions.

In Fiji Kauri, trees are seen growing to perfection in the central hill country beyond Nadarivatu on the island of Viti Levu and the finest specimens occur most commonly at altitudes in excess of 1,500 feet. At this altitude, climatic conditions are by no means dissimilar to those prevalent in the

North Auckland district where the last of the one-time great Kauri Forests of New Zealand alone survive.

So striking is the resemblance borne by the Fijian Kauri to its Maoriland cousin, that there are few who could distinguish any marked difference in the milled product, especially when dressed and polished.

Wandering alone through the forests of the Navai basin—the present centre of the timber industry in this Colony—the uninitiated might easily pass within close range of large, well-developed Kauri trees without discerning them among the tangle of screening undergrowth.

But where a clearing occurs or a break in the canopy of the forest reveals a well defined sky-line, then may the proud head of the Kauri be clearly seen, reared high above the highest of its forest associates.

Clambering up the slopes surrounding Mount Victoria, forest giants may be discovered of immense and satisfying girth, 40 feet and more in circumference: venerable patriarchs that were ancient trees long before George Washington and his legendary axe made history.

Rising to a height proportionate to their girth, these giants rear upwards forty to fifty feet or more of straight clean bole before shooting out the first strong limb to support a massive and ornate head.

Romance attaches to these grandees of the forests; romance associated with the physical history of our world, for these ancients have witnessed changes so remarkable, so obscure, that the accumulated knowledge of man cannot with certainty comprehend them.

Did, perhaps, these forests of Fiji, before being isolated by some immeasurably distant cataclysmal movement, march in uninterrupted column with the Kauri of New Zealand? An interesting if unprofitable speculation this; and yet, who, having viewed the wonders of that deep buried forest at Arapuni revealed only by the force of excavating waters, will deny the possibilities of such fantasy?

But the greatest enemy of the local forest is not flood but fire. The chance ignition of dry undergrowth may cause in a few days destruction of trees which have taken centuries to mature; and what is more serious, the perishing of seed and seedlings in the flames may threaten the total destruction of the stricken forest.

Fortunately, this danger is not an ever present threat in Fiji. The rank and never drying undergrowth, which a well distributed rainfall and even temperature cause to carpet the forests, is Nature's unique protection against the fire menace.

Sheltered beneath the density of this undergrowth, the embryo forest-tree lies dormant in the seed awaiting light and sunshine to prompt germination and release the force of concentrated life.

Without the agency of this light and sunshine, germination is delayed, and, in the gloomy depths of the forest where trees, competing for the vitalising sunshine filter the daylight, regeneration of the forest by natural means is a slow, deferred process.

Modern sylvicultural methods, however, permit the cutting of mature surplus timbers for domestic needs and commercial development whilst providing for the preservation and extension of forests through the medium of natural regeneration. This is aided and encouraged by inexpensive assistance in overcoming competition and by rendering conditions suitable for the proper growth of the desired species.

For the practise of such methods, conditions in Fiji are highly favourable. Subject to conditions laid down by the Conservator of Forests, sawmilling interests carefully cull the large matured marketable trees, cut away epiphytes and clear encroaching or overhanging undergrowth from around seedlings and rising saplings of the valuable species and thus assist them to establish themselves.

Light and penetrating sunshine contribute to the work of restoration and regeneration so that where but one tree grow before the future should see many.

The devastating practice, prevalent in many countries, of denuding the hills of vegetation has been avoided in the central highlands of Fiji, making possible the preservation of timber-supplies for future generations. Unfortunately, in the more accessible coastal areas denudation has left its mark, especially in the dry zones. Here fires are of frequent occurrence and much wastage of timber and of land has resulted. But of recent years serious attention has been directed to the potentialities of timber as a secondary industry and it is hoped that such further losses will be avoided and that development of forests will become a permanent policy.

Local opinion, which for years pronounced the Fijian timbers to be of a quality inferior to those produced in other countries, is not now so vociferous in condemnation, and the time will surely arrive when a proper pride will be evinced in yet another product of this beautiful and fertile land.

In the early days of the industry no doubt this prejudice was prompted by the supply of badly cut, badly classified and probably immature timber. The introduction of modern plant and the application of up-to-date methods of manufacture have improved the quality of the marketable article and succeeded in demonstrating that, grade for grade, local timbers compare in every respect with those imported, with the result that this industry is rapidly approaching a stage when it will assume an important part in the economic life of the Colony.

The timber industry of the future will provide work for the European and Native alike, and thus introduce into a new land a calling of ancient and honorable lineage—the Craft of the Woodsman.

CITRUS DISEASES IN FIJI.

By

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DURING recent years there has been some development of Citrus growing in the Colony and several small commercial orchards have been established. In addition there are many trees cultivated by individuals for private use; besides those growing in a more or less natural state on native owned lands and in the vicinity of native villages.

The total export of Citrus in 1937 was 8,324 cases of mandarins, grapefruit and oranges. In view of the increasing interest shewn in this crop and the possibility of an extension of block planting, a record of diseases and their control is being made. One of the great features of the Citrus tree is its comparative freedom from fungus diseases. Fiji is particularly fortunate also in that the most serious diseases, Canker and Black Spot are not present. The troubles discussed below, however, are not uncommon and may cause considerable damage—both by interfering with normal growth and by reducing yield.

1.—MOTTLE LEAF OR FOLIOCELLOSIS.

This disease derives its name from the appearance of the leaves, but it also affects the development of the fruit and the growth of the whole tree. The leaves show chlorotic areas irregular in outline, situated between the main lateral veins on each side of the midribs. Normal, fully-developed leaves may show the condition but, commonly, affected leaves are small and stunted; the fruit is usually very small and "die back" of twigs and a bushy type of growth occur.

The causes are not fully known. It has been suggested that the trouble may be associated with calcium deficiency, with excessively high salt content of the soil and the presence of heavy root infestation by the citrus nematode (*Tylenchulus semipenetrans*). It is generally regarded as a physiological disease and is common on light sandy soils.

Locally, affected trees have been predominantly Grape fruit and in one case the trees were also suffering severely from Collar-rot.

Control.—In several Citrus growing countries the use of zinc sulphate spray as a corrective for mottle-leaf has proved so successful as to be generally recommended and in local trials this treatment has been used with good effect.

Solutions of zinc sulphate (10 lb to 100 gallons water) with Agral 1 (0·15 per cent. solution) as a spreader have proved useful—when used at the rate of 2–3 gallons per tree. The spray should be applied at the dormant period in the growth of the tree.

2. A similar spray composed of 10lb zinc sulphate, 5 lb hydrated lime, 8 to 10 ozs. spreader and 100 gallons water has been used in South Africa at a cost of from 1½ to 3d. per tree according to size. Trees showing 55 per cent. mottling were restored to health in a few months and the beneficial effects may be expected to last two years.

Applications of zinc sulphate direct to the soil at the rate of 8 lb per tree placed in a narrow circular furrow 18 to 24 inches from the trunk and covered with soil have also been recommended but no trials have been made locally. Broadcasting zinc sulphate beneath the trees has been stated to be ineffective(1).

It is also advisable to promote vigorous growth of the trees by applications of lime, compost or suitable fertilizers.

2.—COLLAR ROT OR FOOT ROT.

This disease is also known as Bark-rot or gummosis and is widely spread, occurring in all citrus-growing countries. The cause is still obscure, although in India, North America and the West Indies it has been shown to be due to *Phytophthora parasitica*, a soil fungus.

In Fiji it has been noted where citrus stock has been budded low down and more particularly on sweet orange stock than on Seville orange.

The disease develops at ground level and rapidly spreads, rotting the bark and ring-barking the tree: decay spreads to the roots and in many cases such root-rotting fungi as *Polyporus* sp. and *Schizophyllum commune* gain entry and completely destroy the root system. In dry weather an exudation of gum may be seen.

In most cases the disease has been well advanced before discovered and so treatment was practically impossible. Occasionally such trees are considered worth saving and inarching has been practised with some success. For this, young Seville orange seedlings 18 months to two years old have been planted about the base of the affected tree and after they have become established are grafted into the healthy stem of the tree above the infected parts.

The main tree has to be cut back severely in order not to put too heavy a drain on the young seedlings which gradually take the place of the dying roots of the trees and subsequently form a new root system. The diseased parts should be cut back to the healthy wood, sterilized and painted with coal-tar.

Seville orange seedlings are used as they are particularly resistant to this disease and in Fiji appear to be the most robust stock for such a purpose. Until the inarched seedlings have grown sufficiently to maintain the branch system of the trees, judicious pruning is necessary and all fruits forming should be removed.

3.—BARK-CRACK.

A somewhat similar disease to Collar rot is a form of Gummosis which causes the bark of stem and main branches to crack and peel off. In dry weather copious gumming accompanies the condition but in the wet zone this gum is not often seen as it is very soluble in water and readily washed off by rain.

The condition occurs on all varieties but most commonly on grapefruit and may be serious enough to destroy large branches, owing to the complete lifting of the bark.

In 1936 many cases of this trouble were successfully treated as follows:—

The diseased bark and wood were cut back with a sharp knife which was sterilized frequently by dipping in alcohol and flaming. The cuts so made,

some being very extensive, were then soaked with the following sterilizing solution:—

Hydrochloric acid (conc.)	.. 15 cc.
Mercuric chloride	.. 1 gram.
Water	.. 1,000 cc.

and later painted over with coal-tar.

The sterilizing solution used is stated by Cunningham (2) to have good penetrating properties and the usefulness of the treatment was fully demonstrated by the complete healing of the wounds and the recovery of all trees treated.

Considerable damage to stems and branches of trees is frequently caused by cultivating implements. If not attended to such wounds form zones of entry for various organisms which cause disease and death of those parts.

All such wounds should be treated in the way described and in an extremely short time will be found to have healed completely.

The solution and the coal-tar paint are always valuable at pruning time to treat all cut ends of lower branches.

4.—SOOTY MOULD (*Capnodium citricolum* McAlpine).

The superficial black blotches on branches, leaves and fruit caused by this fungus are very well known and in many cases spoil the appearance of the fruit of oranges, lemons and mandarins. The casual fungus is not a parasite and does not penetrate the tissues of the plant. It merely lives saprophytically on the honey dew exuded by certain scale insects which may be found in great numbers on all parts of unsprayed Citrus trees.

The Sooty-mould may be removed temporarily by spraying with a fungicide as Lime Sulphur or Bordeaux Mixture but a more permanent control aims at the removal of the scale insect which is primarily responsible. This may be achieved by using a combined spray as follows:—

Bordeaux 3-4-50 + Oil Emulsion 3 quarts applied at blossom fall; and in some cases an additional application of Red Oil, 1 part to 60 parts water, is beneficial.

Fruits disfigured by the black growths of mould may be cleansed by immersing them for one minute in a solution of Boracic acid, $\frac{1}{4}$ lb and Chloride of Lime $\frac{1}{4}$ lb to one gallon of water. The fruit should then be washed well in clean water and dried thoroughly

5.—VERRUCOSIS OR CITRUS-SCAB. (*Sporotrichum citri* Butler).

This disease is extremely common on the rough lemon throughout Fiji and is the cause of the characteristically deformed leaves and fruit.

On young leaves and twigs it forms extensive corky lesions or blisters and often completely deforms and disfigures the fruit. Leaves are susceptible to infection only when less than 15mm. wide and fruits are immune after they have attained a diameter of 20mm.

The casual fungus develops rapidly in moist conditions and may be controlled by spraying with Bordeaux Mixture 3-4-50 or Shirlan A.G. outdoor strength—preferably after pruning and before new growth takes place.

REFERENCES.

(1) Clark Powell, H., and Mathews, J.—*The use of Zinc Sulphate in controlling Mottle Leaf of Citrus Trees.* Publn. Univ. Pretoria, 35 (series 1), 1936.

(2) Cunningham, G. H. *Fungus Diseases of Fruit Trees* 1935.

POISONOUS PLANTS OF FIJI.

By
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It is generally considered that among the plants formerly used by the Fijians for medicinal and other less-worthy purposes were many possessing poisonous principles, but certain knowledge of these is very limited and at the present time reliable information is obtained only with difficulty.

Among the poisonous plants recorded by Seemann (1865) are:—

Antiaris Bennettic Seem., "Mavu-ni-Toga"—Arrow poison.
Oncocarpus vitiensis A. Gray, "Kau-Karo"—"Itch wood."
Excœcaria agallocha Linn. "Sinugaga"—Poisonous sap.
Barringtonia speciosa Linn. "Vuturakaraka"—Fish poison.
Derris uliginosa Benth., "Duva"—Fish poison.

There is no information regarding the possible use of these plants in native toxicology or medicine. They are all common and their properties and uses are fairly obvious and widely known to the Fijians. Of the real or fancied properties both of the many plants used by native herbalists in treating their patients and of those used in the practice of "Draunikau" (witch craft) it may be said that nothing is known.

The latter use is now very rare although its suppression does not appear to have diminished either its physical or pychological effect upon the unfortunate victim in such cases which do occasionally occur. That actual poisons are frequently used has always been suspected and it is therefore of interest to record the identification of even one such plant.

During 1936, in the course of the hearing of a case of witchcraft on Vanua Levu Island, reference was made by witnesses to three plants, Yaro, Baka and Makanavanava as the source of the ingredients used.

The first two, namely *Premna taitensis* and *Ficus obliqua*, are common trees throughout Fiji, but the last named appeared less known. "Yaro" bark occurs in the recognised Materia medica of Fiji, being occasionally exported along with "Toga" Vine (*Raphidophora vitiensis*) to America for use in the manufacture of a proprietary nerve tonic, while "Baka" bark might be expected to have astringent properties.

After careful enquiry the reported name Makanavanua was identified with Manaivanua, a tree known to be poisonous and to be used in the practice of "Draunikau."

Specimens of "Manaivanua" have recently been collected and found to be *Excœcaria acuminata* Gillespie, belonging to an extremely poisonous genus known in Australia, Fiji and Polynesia for its dangerous properties. The tree is described by Gillespie (1932) as follows:—

> "A small, glabrous tree, the branchlets slender, gray, striate, somewhat flexuous. Leaves alternate, 5·5–13 cm. long, 2–4·5 c.m broad; blades entire, pale-green, slightly shining above, dull beneath, thinly chartaceous, elliptic to ovate, apex acuminate, the tip rounded, base acute to obtuse, lateral nerves slender, nearly straight, anastomosing with an inframarginal nerve, veinlets obscure; petioles slender, 1–2 cm. long. Inflorescences spicate, occasionally once or twice forked from the base, 1–2 cm. long; female flowers 1 or 2 at the base of the male spike, or borne separately subsessile on short racemes. Bracts of the

male flowers densely imbricate, almost as wide as the spike, rounded, crenulate, minutely cuspidate at the apex; perianth segements (3) lanceolate, shorter than the 2 or 3 stamens, often laciniate near the base. Female flowers about 3 mm. long, the perianth-segments triangular, ovate, crenate-ciliate nearly equalling the globose ovary; stylar column distinct nearly 1 mm. long, the lobes acuminate, recurved. Capsule about 12 mm. long, 16 mm. broad, the valves woody; seeds subglobose, brown, more or less lined and spotted, about 5 mm. in diameter."

Gillespie records this tree from Namosi and Nadarivatu in Viti Levu so that the present record extends its known range to Vanua Levu.

FIELD NOTES ON COTTON GROWING IN FIJI.

By

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For a number of years now the Department of Agriculture has been interested in stimulating the growing of cotton as an export crop with an assured market. This interest has included all aspects from breeding and selection work to the growing of the commercial crop, and its ginning and marketing.

Close contact has been maintained at all times with the private growers. This year it has been possible to offer a slight increase in price for seed cotton and cotton planting is likely to cover a wider range in these Islands. Therefore it may be of interest to note a few of the results of practical experience in the field.

To commence with the seed: it is of common occurrence for one to be asked why other varieties are not tried and why a strict control of seed supply is held. The answer is that a very complete assortment of varieties has been tested under Fiji conditions and the types now being encouraged by the Department of Agriculture are the best for local conditions. The value of cotton depends to a high degree on its uniformity, and this depends principally on the purity of any one strain. Continuous selection work is being carried out by the Department and great harm would be done if, as the writer remembers finding, a grower had obtained seed of another variety and had put a neat border of this around his commercial plot of cotton.

The cotton plant suffers from a reputation for hardiness so that any soil is regarded as suitable. Sown in the right season cotton will do surprisingly well on poor soils but a large number of the present growers plant cotton as as afterthought after rice-planting is over, and therefore too late. Even then a greater yield per acre is expected than is the average in many cotton-growing countries.

The three major soil problems met with have been:—

(*a*) Some deep black soils have a deleterious effect on the germinating seed which requires much re-supplying.

(*b*) Some soils have a tendency to cake hard on the surface after rain. Indians may be seen prising off the caked earth from the struggling seeds, but a more practical method is to sow 6 to 10 seeds at each hole. Those burst out by force of numbers and the rest is the survival of the fittest.

(*c*) Many soils on hill-slopes when cultivated are very subject to erosion under normal rainfall. Many complaints are made that the cotton has been washed out when all that is required is sowing on ridges and perhaps the protection of the plot by a small drain on the upper side.

Given a reasonably well prepared seed-bed the maintenance of cotton in Fiji resolves itself into a little weeding and thinning-out until the plants meet to form a canopy over the earth and perhaps one weeding before harvest to facilitate picking. The plant is intolerant of wet, so reasonable care should be taken to avoid planting where exposed to seepage or excess surface-water. There is also a tendency to space the cotton too widely in sowing the seed and while 3 ft. x 6 ft. spacing is generally adaptable, in poor soil this distance can usefully be reduced to 3 ft. x 4 ft.

The picking is an important factor and acreage is strictly limited by the assured pickers available. About two pickers can comfortably attend to one acre.

A very sore point with growers has been the labour entailed in picking over the seed-cotton to sort it into grades. Undue picking-over is also a complaint of the buyer who has to deal with a lot of twisted cotton mixed with broken leaf. The solution is to pick clean in the field and it is recommended that two bags should be used, one for the obviously clean and the other for doubtful product. A good picker can by this system reduce "picking-over" to the pleasant task of picking out clean seed-cotton from the doubtful heap to add to the first grade.

The above are a few notes which may prove useful to the grower of what can be a profitable and pleasing minor crop. The scarcity of labour will prevent cotton being a plantation crop in Fiji, but it certainly has a future as a smallholder's crop and as a very useful rotation crop or even in mixed cultivation. The moderate returns last season will, it is considered, materially stimulate this crop in the next few years.

NOTES ON THE CULTIVATION OF EUROPEAN VEGETABLES IN FIJI.

By

H. W. SIMMONDS, O.B.E.,

and

D. A. DONALD, H.D.A.

It has now been shown that in the soil in many parts of the world there is a definite deficiency of certain essential minerals, either actually or in a form available for plant-food, and this deficiency is reflected, not only in the growth but in the actual mineral contents of the resultant herbage.

This mineral deficiency in the herbage is further reflected in the low percentage of " solids-not-fat " in some milks whilst in human beings it shows as a liability to boils, tropical sores, ulcers and in the early decay of teeth. It follows therefore, that a supply of dietically complete vegetables is an absolute essential to human health in the tropics, as elsewhere, both for mineral and necessary vitamin contents.

In the humid tropics the difficulty of supplying such high grade vegetation is greatly increased by the heavy rainfall, which by leaching out the soluble nitrates and lime causes an acid condition of the soil in which such phosphates as are present may be locked up in a form unavailable as plant-food, as also, may the potash.

Formerly and to some extent still, the Fijian natives unconsciously overcame the insufficiency by eating quantities of fish and seaweed which are rich in mineral salts. It is to be deplored that, even in small islands, so much tinned fish is now consumed and it is suggested that efforts might be made by local merchants to supply the natives with salted fish in place of the tinned article.

THE VEGETABLE GARDENS.

In the formation of a vegetable garden designed to supply these dietetic deficiencies the first consideration is the construction of a compost heap, in order to replace those organic elements of the soil leached out by rain or removed as crop or weeds. Such organic material is also of the utmost value in improving the texture and water-holding capacity of the land. There are various ways in which such compost heaps can be made. In the wet climate of Suva a heap of grass cuttings, leaves, peelings, &c., mixed occasionally with a little soil serves the purpose. After about four weeks it is turned over and tramped down and further additions of grass, leaf, &c., are made. About four weeks later it is again turned over, tramped down and covered with about four inches of soil, after which cucumbers or rock melons can be planted on top and a new heap commenced. In this way no space is wasted and by the time the crop is finished the heap has generally rotted sufficiently to be incorporated in the soil.

Where climatic conditions are drier the compost is best made in a shallow pit since it is essential that the heap should be kept moist, and, in all cases, the addition of a certain amount of cow or horse droppings is advantageous in hastening the decomposition.

DRAINAGE.

Care should be taken where the land slopes to prevent soil-wash by making contour drains and not the straight up and down ones which are so commonly seen. Also, to prevent erosion on sloping hill-sides under the conditions of tropical rainfall, terraces should be constructed to follow the contour of the

slope. In successful vegetable production it is essential that steady, continuous growth of the plant be maintained. So that, having secured good soil and arranged for an adequate supply of organic and inorganic plant-food constitutents, attention must be paid to the regular supply of sufficient water. Even with the copious rainfall of Suva watering is frequently necessary as is the provision of suitable drainage, since the free movement of the soil-water causes proper aeration and promotes the availability of plant foods.

MANURING AND LIMING.

As stated above, many tropical soils are deficient in necessary minerals or, if such are present, they are in a form when they are not available to the plant. Many of the soils also are distinctly on the acid side rendering liming necessary and this is always so with the red lateritic types so common in the tropics. In this last case the use of coral sand (95 per cent. calcium carbonate) is probably the best method of applying the lime, its action being much more prolonged, whilst it also tends to improve the texture of such soils.

The use of some form of phosphate is also generally necessary and this can be applied either as basic slag, which is slow in action, or as the quicker-acting superphosphate. It must be remembered however, that if the latter is used continuously it will tend to increase acidity and additional liming may be required. The soapstone rocks of the Suva district have been shown to be rich in potash and lime and, where these are incorporated in the soil in quantity liming should not be necessary. In other districts however, the addition of potash is likely to give useful results.

PLANTING METHODS.

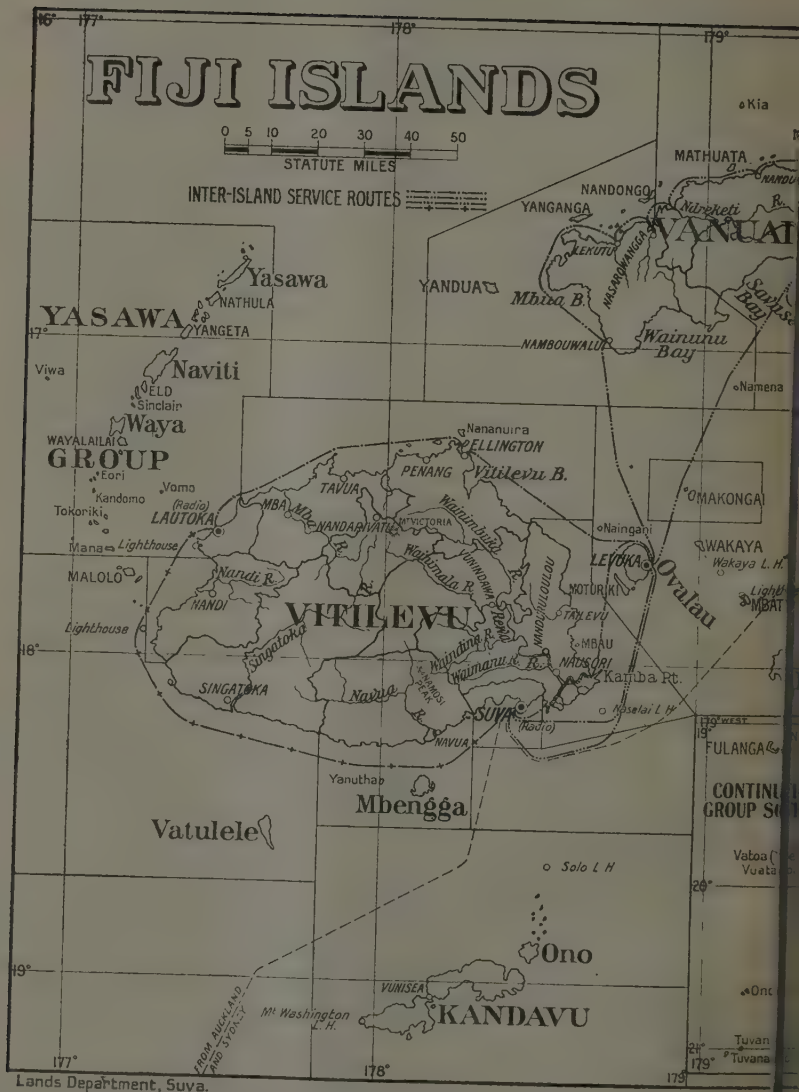
Beans (French).—These can be grown throughout the year except in periods of continuous rain, and they form a great standby in the tropics. They are sown directly into the ground but can be transplanted, in wet weather, if required. They are subject to root disease and such diseased plants should be pulled up and burnt.

In Fiji the usual variety grown is Canadian Wonder, which does remarkably well. " Burpee's Stringlers " gives perhaps a more tender bean and comes into bearing earlier. It does not, however, crop so heavily, whilst the vine is extremely brittle. Two other food varieties are Sutton's " Premier " and Sutton's " Golden Waxpod," the latter producing a wonderfully even crop. Of the climbing varieties " Epicure " grows well but the crop produced is not great.

Beet.—These cannot be said to do well on the Suva soapstone. This is partly due to the destruction of the seed, when planted in the open, by some agency, probably millipedes and largely to foliage destruction by the larvae of the Pyralid moth, *Hymenia fascialis.* No doubt these latter could be controlled by dusting with pyrethrum powder and a trial might be worth while. Excellent beet can be grown on the volcanic soils of Taveuni, where, although *Hymenia* is present, it seems to be largely controlled by an *Apanteles* parasite.

Beet Silver.—This grows excellently but the foliage is soon skeletonised by the larvæ of the abovementioned moth.

Cabbage (English).—English cabbage as a rule grows well in the cooler season of the year. The seedlings should be treated as described for cauliflower below. Any early variety, such as early " St. John's Day," " Early Drumhead " or " Succession " can be used. The last named, however, does



Lands Department, Suva.

180°
179°
178°
Undu Pt.
Lighthouse
Ndrua
VISONGO
Nggelelevu
Nukumbasanga
TO VANCOUVER VIA HONOLULU
TO SAN FRANCISCO VIA SAMOA AND HONOLULU
Kumbulau Pt.
Rambi
Thombia
Yanutha
Natewa Bay
KIOA
Thutha B.
WAIYEVO
(Radio)
LAUTHALA
NGAMEA
TAVEUNI
Wailangilala
Lighthouse
Vuna Pt.
SALIALEVU
NAITAMBA
17°
Bay of Islands
Avea
Vanuambalavu
Thikombiailau
YATHATA
Kaimbu
KANATHEA
LOMALOMA
Susui
MUNIA
Vatuvara
Mango
L A U
Katafanga
JUVUTHA
Yaroua
Thithia
S E A
NAYAU
18°
Bacon Id
Vanuamasi
Lakemba
Aiwa
VANUAVATU
G R O U P
ONEATA
Olorua
Komo
MOTHE
Karoni
Moala
WANGAVA
NAMUKAILAU
Navutuira
Totoya
Kambara
Yangasalevu
Navutuiloma
Marambo
Matuku
Fulanga
ONGEALEVU
Ongeandriki
180°
179°
178°

not stand so well after hearting as the others. Sutton's " Pride of India " in sweetness, tenderness and ability to stand after hearting has been found the most successful. Cabbages can be grown from the slips which form after the head has been cut. These slips are said to heart with greater certainty but, the writers have not used this method so far.

Cabbage (Chinese).—This can be grown throughout the year, requiring similar treatment to English cabbage. Under dry conditions it requires water or otherwise will show a tendency to run to early flowers.

Cauliflowers.—Cauliflower is now grown regularly in the tropics, using Indian raised seed. It requires good soil and regular application of liquid manure. The seed may be sown broadcast, in a well prepared bed or in a seed-box. When two to three inches high the plants should be transplanted into rows six inches by six inches. When about six inches high they should be planted out into rows two feet by two feet apart. On the dry side of Fiji, Sutton's " Early Market " has proved a good variety, whilst in the Suva district Sutton's " Benares Main Crop " has given the best results.

Cabbages and cauliflowers suffer from the attacks of cutworms at times, whilst the small cabbage moth, *Plutella maculipennis*, sometimes ruins a crop. Dusting with pyrethrum should control the latter, but poison baits are the only satisfactory methods of dealing with cut worms.

Carrots.—This vegetable can be grown throughout the year. It requires a light soil and the seed must be sown directly into the ground as the young seedlings will not transplant satisfactorily. They should be thinned out to about two inches apart and when the roots are about half grown they can be thinned again, and eaten.

When small the sedlings require a certain amount of shade on hot, sunny days.

Corn (table).—Ordinary sweet corn does not generally do well in the tropics. A hybrid Sweet x Guam White obtained from Hawaii has, however, given excellent results in Fiji. A Puerto Rico selection from the hard type has also done well: it is not so sweet as the preceding hybrid but the cobs are well filled and tender and the plant seems more resistant to disease. It is however, taller and more liable to damage by wind.

Corn can be grown throughout the year, providing it gets sufficient moisture. It requires good soil and is planted two seeds to a hill about three feet apart, in rows about four feet apart. In Suva, superphosphate applied when planting followed by a little sulphate of ammonia when the plants are about six inches high, gives satisfactory results.

Cucumbers.—These can be grown anywhere, at any time, but, as stated above, form a useful cover to the compost heap. They do not transplant well, so must be sown directly into the soil and thinned out to two or three plants to a clump, each clump being about six feet apart. The plants require an abundance of water and liquid manure. Anderson's " Commercial " has proved a satisfactory variety in Suva, but most growers save their own seed from their best plants.

Endive.—For those who like it, this salad can be grown throughout the year. Treatment is similar to lettuce and is detailed below.

Lettuce.—The small " mignonette " variety of lettuce can, with care, be grown in Fiji throughout the year. The larger types of cabbage lettuce often do well in the dry season.

In the cool season lettuce can be sown openly in good soil which has been top-dressed with superphosphate and shaded until the plants form their second pair of true leaves. They should then be thinned out to nine inches apart and some transplanted elsewhere. A good situation is between two rows of corn which will provide some shade.

In the wet season more care is required and a good plan is to sow the seed in tins and transplant when in the first cotyledon leaf-stage into other tins, placing the young seedlings about three inches apart. When the young plants have formed a good root-system and are about three inches high, they can be put out into well-prepared ground, choosing an overcast day if possible, and disturbing the roots as little as possible. Some temporary shade is generally required, but lettuces require plenty of light and water. Two or three waterings with weak sulphate of ammonia, especially in dry weather, greatly improves the growth and quality of this and all green vegetables.

Melons (*Rock*).—These require very rich soil and, like cucumbers, do well on a compost heap. They should be treated exactly like cucumbers, but require more manure. The ripening fruit is very liable to sun-scald and should be shaded when it approaches maturity. Anderson's "Emerald Gem" has given excellent quality fruit, whilst many of the large varieties do well, but give fewer fruits.

Peas.—These are difficult to grow on the wet side, but Yorkshire "Hero" sometimes gives a good crop. In the dry zone they do much better and Sutton's "Matchless" and "Best of All" have given very promising results. Peas require good soil with plenty of humus, but if the compost has only recently been dug in the millepedes play havoc with the seeds. A reserve can, however, be planted in tins, as they transplant well when small.

Potatoes (*English*).—These can be grown in the cool season on the dry zone. They require good soil.

Tomatoes.—Tomatoes in Fiji, as elsewhere, are subject to a number of diseases, the most disastrous of which is bacterial wilt. No definitely resistant strains to this disease are known, although the small feral cherry tomato sometimes grows well on land known to be affected with the bacillus. Various methods to guard against this trouble have been tried including sulphuring the soil, also growing the plants in pure broken well-weathered soapstone which proved successful, and gave an excellent crop. Another method tried was to sow the seed at stake to avoid root damage when transplanting but although good results were obtained control plantings did not indicate that these results were due to the method. One plant, however, grown on soil known to be affected, has twice developed every symptom of the disease and twice recovered. Seed from this plant is being saved for further trials. Generally speaking, the trouble is prevalent in warm wet seasons, but diminishes in cool dry weather. Of various varieties tried, Sutton's "Best of All" has given good crops of small, high quality fruit and this firm's "Golden Perfection" produced a beautiful fruit of larger size. "Stone" is another variety of the highest quality and of good size, whilst "Kondine Red" was excellent, but smaller and somewhat more susceptible to wilt. "Maryglobe" also produces good yields of medium-sized fruit of good appearance, suitable for export. "Burwood Prize" in the Suva district proved a very poor fruiter on each occasion when tried.

Spinach (*N.Z.*).—The seed of this useful vegetable is irregular and slow in germinating. This difficulty can be largely overcome, however, by immersing in very hot water for a minute or so just prior to planting, which should be done in a tin or warm, moist bed. Each seed has several embryos and may produce as many as six plants. These should be pricked off when still in the first leaf and planted out into good soil after the second or third pair of true leaves appear. The plant produces a number of crops of excellent quality, four or five plants yielding sufficient for a meal for four persons.

A PRELIMINARY NOTE ON LARVAL PARASITES OF THE SPIKE MOTH IN TAVEUNI ISLANDS.

By

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DURING the years 1930 to 1933, no less than four parasites (egg, larval and pupal) of *Tirathaba rufivena* Walk., were introduced from Java into Fiji against the local *T. trichogramma* Meyr., which has five native parasites. Paine, who made most of the liberations, wrote (1) in 1934 "if, during the next few year *Apanteles*" (a Braconid parasite) "does not show a much increased population at Mua or Vuna on Taveuni, it will have to be regarded as a relatively unimportant enemy of *T. trichogramma* as in these places *Apanteles* is still extremely scarce."

During October, 1937, the writer made a short visit to Mua Estate and collected *Tirathaba* larvæ of all stages. These have been reared to adults in the laboratory in Suva and gave the percentage parasitism as in the following table. (The number of larvæ used for the percentage parasitism of *Apanteles* and *Nemeritis* is different from that for the other parasite as more than half-grown larvæ must be ignored. This is because they have already escaped parasitism which can only befall them during stages prior to the fifth or last instar). The egg parasite *Telenomus tirathabæ* Ferr., is not included.

Parasite.	Description.	Percentage parasitism.	No. of larvæ examined.
Apanteles	Small black Braconid, 3 mm. in length	2·5	165
Nemeritis	Black and orange Ichneumonid, 10 mm. in length. ..	0·8	165
Erycia	Squat fly. Grey body, orange patch at base of wing. 7–8 mm. in length	·41	185

It is realised that larger numbers of larvæ will have to be bred before significant data can be obtained but the abundance of these pests, despite the very satisfactory control by the Tachinid *Erycia*, shows that they are not yet under close control on certain portions of Taveuni despite seven years during which the parasites have had time to become established. In 1931 (1) the author suggested that the scarcity of *Apanteles* might be due to a rapid spread over the island from the original point of liberation. This seems borne out by Paine who shows (1) that it was more abundant in the north at Nacaugai, where no parasites were liberated, than at Mua and Vuna where they were; in fact, during September, 1934, the percentage parasitism at Mua was nil.

Since Paine's paper, additions have to be made to the local parasites of *Tirathaba* which now are known to be five in number, viz:—

1. *Trichogrammatoidea nana* Zehnt.—A very minute egg-parasite whose effect is stated by Taylor (3) to be negligible.

2. *Meterorus trichogrammæ*, Wilk.—A brown Braconid 4 mm. long regarded by Taylor as of little value as a control against the larvæ.

3. *Echthromorpha immaculata* Krieg. (Formerly referred to as *E. diversor* Morley).—A large Ichneumonid 15 mm. long, orange and black in colour. According to Taylor its parasitism of the pupæ does not exceed 3 per cent.

4. *E. tirathabæ* Perk.—Like the preceding but with a marked difference in size between the sexes, the female being 13 mm. long and the male only 7 mm. Bred from pupæ (?) by Taylor and Paine from Taveuni.

5. *Antrocephalus renalis* Waterst.—This black Chalcid pupal parasite has a large range in size, females from 4·5 to 8 mm. and the male from 5 to 6 mm. First specimens in Fiji bred by the writer in February, 1931, but previously recorded from Java by Paine.

(1) Paine, R. W., 1935. Department of Agriculture, Fiji, *Bulletin* No. 18.
(1) Lever, R. J. A. W., 1931. Department of Agriculture, *Agricultural Journal*, Vol. 4., No. 2.
(3) Taylor, T. H. C., 1930. Department of Agriculture, Fiji, *Bulletin* No. 17.

HINTS ON COLLECTING AND FORWARDING OF INSECTS.

By

R. J. A. W. LEVER,
Government Entomologist.

PLANTERS, and other settlers who live away from the vicinity of Suva, wishing to send to the Department of Agriculture specimens of insects damaging their crops or garden plants may find the following information of some use. It is hoped that by its means the material sent may arrive at headquarters in the best condition for examination.

Live insects, such as caterpillars, require both sufficient food and ventilation. The food-plant should be so packed that there is no chance of water leaking from the receptable holding it while adequate ventilation can be obtained by boring holes in the box or tin if wire gauze cannot be used. Closed tins without some form of ventilation result in fermentation or condensation and this will spoil the contents. A label with "live insects, immediate delivery," should be affixed. For very short journeys there is clearly less need to take such precautions.

Delicate insects such as aphids, thrips, lice, ants and small flies should be put in small tubes or bottles of methylated spirits, formalin or alcohol. Harder and more robust insects such as beetles, bees and wasps may be packed in tins with carbolic acid or powdered camphor-balls and fine sawdust or cotton wool to prevent injury.

Butterflies are best sent by placing them within rectangular pieces of smooth paper which have been cross-folded into the shape of a triangle and the overlapping edges turned down.

Scale insects should be kept on the leaf which is then pressed between blotting paper under a heavy weight.

Large moths, stick-insects and grasshoppers should have their viscera removed with a pair of fine scissors and the abdomen filled with cotton wool.

Attention should also be given to packing as violent jarring may be expected on a journey in small cutters or schooners—corrugated cardboard and "wood wool" are two of the best substances as shock-absorbers.

While the material is being kept preparatory to shipment it is important to place it out of the reach of ants which in an hour or two may damage the whole collection and make it useless.

Accompanying the specimens should be the name of the crop attacked, particulars of the portion so attacked and its age with the date and exact locality. If possible, samples of the damaged tissue should also be sent or a rough sketch if this is impossible.

THE GIANT TOAD.

By
R. J. A. W. LEVER.

THROUGH the kindness of Mr. H. W. Simmonds, O.B.E., a dead toad, *Bufo marinus* (L.), was forwarded early in November to the writer's laboratory for scrutiny. The amphibian was found at the point of death in association with two others which were mating and are believed to have killed it.
A post-mortem examination showed the specimen to be an immature female. The stomach-contents revealed the following:—

14 slugs—1 large.
9 millipedes (8 red and 1 grey).
1 small univalve shell of a kind eaten by mynah birds.
Fragment of pond-weed and leaves.
1 piece of wood, $\frac{3}{4}$ of an inch long of the diameter of a cheroot.

The most interesting point in the above is the addition of millipedes to the diet as it has been shown previously (1) (2) that the red millipede was rejected when fed to this toad in the laboratory. Fragments of other millipedes were also present in the stomach and the contents of the intestine showed invertebrate remains but these were in too advanced a stage of digestion to permit of identification. In Jamaica millipedes are frequently eaten and one would therefore expect them to be attacked elsewhere.

A colony of tadpoles of this toad was released by the writer at Navua in September and adults have also been forwarded to Taveuni Island where tadpoles were first sent in May of this year.

The toad family is known to have a milky secretion from certain skin glands whose effect on the heart and central nervous system may be severe. It is interesting to record local cases of poisoning of young fox terrier dogs which have attacked *B. marinus* in Suva. The symptoms shown were dilated pupils, tetanic spasms and copious salivation. The animals responded to treatment by the Veterinary Division.

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(1) Simmonds, H. W., 1937. Proceedings Royal Entomological Society, London. Vol. 12, Pts. 4-6.
(2) Simmonds, H. W., 1937. Ann. Bull. Divisl. Reports for 1936, Fiji.

VETERINARY NOTES.

By

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PROGRESS IN TUBERCULOSIS ERADICATION.

Prior to 1931 five dairy herds in Suva had been rendered free of tuberculosis by means of the tuberculin test. The test used in those days was the subcutaneous test with which many dairy farmers are familiar. The application of this test was a tedious affair, necessitating frequent visits to the dairy and numerous readings of the thermometer, since the test depended on the temperature reaction of the cow following the injection of the tuberculin.

In 1931 the Veterinary Division commenced to use the recently introduced double intradermal tuberculin test. In this test concentrated tuberculin is injected in minute quantities actually into the skin, care being taken that the dose does not penetrate into the tissues underneath the skin. The decision as to whether the animal is tubercular or not is derived by judgment of the reaction which occurred in the skin surroundings the site of the inoculation. Whereas the subcutaneous test could be performed within a 24-hour period, the intradermal test requires a period of 72 hours for the completion of the test. In the former case however, owing to the frequent visits and attendance on the cattle (6 visits within the 24 hours) it was not a convenient test for the officer to perform when he has numerous other duties. In this case of the intradermal test three visits only are made, with an interval of 48 hours between the first two and 24 hours between the second and third visits. For an accurate reading of the test one is not bound by the necessity for exact punctuality, and the visits can be made at convenient hours to suit both the farmer and the veterinarian. It is seen from this that the test is a more convenient one for all concerned and the introduction of this test has enabled marked progress to be made in the eradication of tuberculosis by tuberculin testing during the last 6 years.

As before mentioned, five herds were entirely free from the disease in 1931 and at that time the total incidence of tuberculosis in herds under test was slightly over 18 per cent. By 1935 twenty herds in the Suva district were entirely free and the incidence of reactors in all dairy cattle tested in the Suva district had fallen to 0·4 per cent. No clinical cases of tuberculosis were manifest among the reactors. At this stage, towards the end of 1937, the total number of dairies entirely free still remains at 20, but among 7 other dairies on the Suva register only 16 reactors have been found and in this year 200 more dairy cattle were tested in Suva than was the case in 1935. It is seen that the number of reactors is slightly more than in 1935. This is accounted for in that a difficult situation occurs which has not yet been overcome since it is still necessary for several dairy farmers to send dry stock away from their dairy farms to remote pastures, otherwise there would be serious overstocking on the dairy premises. It is difficult to ensure that these cattle remain in isolation during these periods. In practice probably they do not and contact with untuberculin tested cattle takes place. Where odd reactors occur in herds previously free, it is usually found that the above conditions exist, infection having occurred whilst dry cows have been pastured elsewhere than on the registered dairy premises.

In the Public Health Regulations published in May of this year, provision is made for the extension of the tuberculin test to all registered dairies throughout the Colony. The application of this provision must be a gradual process.

It is realised that the individual farmer or the dairy industry as a whole would not be able to stand up to an sudden large loss of milking cows which would almost certainly occur were the Regulations to be at once rigidly enforced. It is envisaged therefore that the eradication of tuberculosis from these outside dairies will be a gradual process leading to almost complete eradication at the end of five years. It is hoped that this will be accomplished without any great financial loss to the farmer or retardation of the progress of the dairying industry. It must be understood by dairy farmers that the officers of the Agricultural Department, to whom this work is entrusted, aim to accomplish the task with as little inconvenience and loss to the farmers as is possible, and the co-operation of all dairy farmers is therefore sought.

INFECTIOUS KERATITIS.

This disease of cattle and sheep continues to cause a certain amount of annoyance to stock owners. The disease is manifest in its severe stages by an ulceration of the centre of the glassy front of the eye, the ulcerating area being surrounded by a milky zone of opacity. The animal at this stage is temporarily blind. On the appearance of this disease on a farm, steps should be taken to isolate affected animals, since it is definitely contagious. At the same time treatment should be adopted. Many different medicaments have been found effective in the treatment of the disease; some of these are as follows:—

(1) The instillation into the eye of a small quantity of ½ per cent zinc sulphate solution.
(2) The application within the eyelid of a pea-sized portion of yellow oxide of mercury ointment of 2 per cent strength.
(3) The blowing into the eye of an antiseptic powder such as calomel in finely divided state or equal parts of boric acid and iodoform.

In spite of the very severe injury sustained by the cornea (glassy portion) of the eye during this disease, it is remarkable that complete loss of sight seldom occurs. One can hope to bring about reasonable healing in most cases of the disease. It is very rare for an animal which has been cared for whilst so afflicted to lose the sight of both eyes, whilst the loss of sight in one eye would not occur in more than 5 per cent. of cases.

Bacteria are responsible for the severe inflamation that occurs and infection may be spread from calf to calf by contact or through the agency of flies.

CONTAGIOUS ABORTION.

No fresh outbreaks of contagious abortion have been reported during the year and the position relating to the control of this disease in Fiji must be considered very satisfactory. On those dairy farms also where the disease has been known to occur for some time the incidence has been becoming less so that during this year few if any farms have suffered any great loss.

It is well known that herds infected with this disease tend to develop a high herd-resistance to it so that few cases of abortion are met with in adult cows. In these herds, however, it is usually expected that some cases of abortion will occur among heifers.

For several years prior to 1937 the Department of Agriculture has been carrying out innoculations of non-pregnant heifers with live-abortion vaccine in a large herd where previously the number of abortions had assumed large proportions. According to information available in the Department of Agriculture, 18 per cent. of abortions was experienced at one period. During

this year the incidence has fallen so low that the proprietor has not considered it worth while to have the innoculations continued. Whether he is wise or not in this decision remains to be seen, but the results of the next few years are awaited with interest.

Abortion in the heifers which were innoculated with a live vaccine have been very few. This indicates that the introduction of these living abortion bacilli by the subcutaneous route into the body of these heifers has not proved harmful. The evidence is strong that the procedure has materially helped to reduce the incidence of the disease amongst these animals.

EPHEMERAL FEVER OF CATTLE IN AUSTRALIA.

Those who have in mind the importation of cattle into Fiji will be interested to know the present position relating to Ephemeral Fever (Three-Day Sickness) of cattle in Australia. The Department of Agriculture has been in frequent communication with the Veterinary authorities in Australia relative to this complaint and the possibility of removing the embargo on cattle from that country. During the winter months the disease became greatly lessened in its incidence so that no records of its appearance in Victoria have been received for some time whilst in New South Wales very few cases have occurred. It is feared, however, that with the onset of warm weather there will be a recrudescence of the disease and until sufficient time has elapsed to see what happens in the summer months, it is not deemed advisable to remove the embargo.

STERILIZERS FOR DAIRY FARMS.

The new Public Health Regulations published in May require that all dairy farms shall be registered. To qualify for registration a minimum standard of sanitation and equipment to the satisfaction of the Inspector is demanded. One of the articles of equipment which an Inspector will demand is the provision of arrangements for providing hot water and the means of scalding utensils. The most primitive arrangement is the kerosene can for boiling water. Better than this is the standard 12-gallon laundry copper for the production of boiling water. To boil 12 gallons of water, however, is a long process requiring a considerable amount of firewood.

The attention of dairy farmers is drawn to the fact that there are now sterilizers for dairy farms on the market which makes the production of boiling water and steam for sterilization on the farm an easy matter. These sterilizers may be fired in some cases by wood and in others by crude oil whilse some are adapted for either fuel. Large quantities of water may be rapidly boiled in the apparatus and in addition it is possible to utilize superheated steam in a suitable cabinet, such as an inverted barrel, for the steam sterilizatlon of various utensils. The use of this sterilizer is a distinct advancement in dairy hygiene.

In constructing new dairy premises or in repairing old ones, the installation of a sterilizer is urged on farmers. In addition to the undoubted improvement in dairy sanitation which follows the installation of the apparatus, it removes one of the chief sources of drudgery on dairy farms and thus tends to make the life of a dairy farmer more congenial. Particulars can be obtained on application to the Department of Agriculture.

DERMATOMYCOSIS IN DOGS.

The term mange is used to signify that class of disease of the skin of animals caused by infection with parasites of the mite family. Dermatomycosis is the scientific name for the disease caused by the infection of the skin with parasitic fungus. The term " ringworm " is often used when referring to

dermatomycosis. Ringworm in the dog, however, does not very closely simulate typical ringworm as seen in other animals. To a casual observer, however, it very closely resembles mange. It is characterised by reddening of the skin and itching. At times small red pimples occur and there is a general scurfiness. Loss of hair occurs over the infected areas. The base of the tail, along the back and sides of the dog are the sites most commonly affected.

In the laboratory, dermatomycosis must be differentiated from mange. This is done by finding the fungus spores affecting the roots of the hairs in the one case or finding the mange mite parasite in the other. Experience in Fiji indicates that mange is a much more easy condition to deal with than so-called "ringworm."

Dogs infected either with mange or with ringworm should be clipped closely. This is best done with barber's hairclippers. The animal should then receive a bath in Potassa sulphurata solution using one oz. to the gallon of water. This solution should be allowed to dry on the dog.

The applications which may subsequently be made to the skin of the dog with a view to curing the condition are many. A cure however, cannot be guaranteed with any one of them. In some dogs one particular type of medicament produces good results, and fails in another. Among the applications which may be tried are:—Tincture of iodine; saturated solution of salicylic acid in iodine on very small areas; salicylic acid in methylated spirits; Friars Balsam on limited areas; sulphur ointment; zinc oxide and several proprietary ointments.

These notes may be of use to country residents where easy reference to a veterinary surgeon is not possible.

HERD-TESTING.

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HERD-TESTING in Fiji has not been given the prominence its importance undoubtedly warrants. In most dairying countries, competition for the world dairy products markets is so keen that every measure for lowering production costs and increasing the yield has to be adopted or the industry languishes.

Herd-testing indicates to the farmer his low-production cows and the wise man will at the earliest moment eliminate these animals from his herd. Further, he will be warned by this test that the progeny of these low-production cows will probably be unprofitable to him and hence he will not retain such stock for milk purposes. On the other hand he can, by the selection of heifers from his best producers, build up his herd to that stage when all the members are individual profit makers.

In Fiji, where the dairying industry had started practically from scratch after the War, it had first been necessary to build up the numbers of milking cattle. Most owners adopted the principle that it was better to have a herd sufficient in numbers to use up the available pastures, even if a considerable number of these animals were low butter-fat producers. The disastrous floods and hurricanes of 1929 and 1931, by causing considerable

losses amongst dairy cattle further retarded the time when the numbers of dairy cattle were sufficient to satisfy the demands of the dairying industry.

A protective duty on butter and a more recently imposed duty on certain vegetable oils further widened the local market for butter-fat, called for a greater consumption of butter-fat and retarded the time when the number of cows in the dairy industry was sufficient for local demands.

At the present moment, local demands are practically satisfied and any further increase in butter-fat production will have to be absorbed on the open markets of the world against competition from other butter-producing countries. It is doubtful if, with the present per head yield of butter-fat, butter could be economically produced at world parity rates.

It would therefore seem desirable that the regular testing for butter-fat production should now be undertaken by Fiji dairy farmers for the following reasons:—

Regular testing indicates the most productive cows. The test should be continued over the lactation period as this gives a true indication of the cow's worth; spasmodic testing only indicates yield at the time of test and this may vary considerably from different causes.

Testing of the progeny of cows indicates those cows which are transmitting their producing qualities to their stock. The same applies to the progeny of the bull. It is a known fact that some bulls with excellent butter-fat backing do not transmit their qualities to their progeny and where it is found that the progeny of good cows are regularly showing a less butter-fat production than their dams, it is a good policy to replace such bulls.

Herd-testing gives the owner a more thorough knowledge of his herd. His interest naturally becomes keener and he will give greater care and attention to his better cows. If, for instance, a cow which he knows to be a good producer has a poor lactation period through some illness, he will endeavour to get her fit for the next lactation period instead of getting rid of her as he may be tempted to do if she was an unknown quantity as far as yield is concerned.

In the selection of calves for ultimate inclusion in the milking herd, the dairy farmer can be largely guided by the knowledge he has gained from their mothers. He will not have to rear large numbers of calves in the hope that a fair percentage at least will turn out to be productive animals. Also, by fewer numbers the productivity of which is fairly certain to be good, the farmer is enabled to give greater care to them in matters of feeding, hygiene and general husbandry. He is thus assured that these animals have a better chance of reaching a healthy and well grown maturity than would be the case where he is obliged to keep large numbers improperly cared for.

Where test-records are regularly kept, the farmer often gains and records other useful information apart from that directly obtained from such tests. For instance, he learns the average milking periods of each and the number of services required for each cow. Records of illness, abnormalities in calving or injuries may be made. Sudden decreases in yield of either milk or butter-fat will be more readily noticed and investigation into the cause of these can be made.

Thus not only does herd-testing give general useful information in itself but it also teaches the farmer to be more observant, to take a keener interest in his herd, and, by knowledge gained, uplift the general husbandry of the herd with subsequent profit to the owner.

THE INTERNATIONAL SUGAR AGREEMENT.

By
A. B. ACKLAND,
Inspector of Produce.

A FIVE years agreement to regulate the production and marketing of sugar was signed in London on the 6th May, 1937, by the representatives of 21 producing and consuming nations, covering about 90 per cent. of the world's output.

The agreement was negotiated at a conference summoned in the name of the Bureau of the World Monetary and Economic Conference of 1933, and was signed by delegates of and on behalf of the following Governments:—

The Union of South Africa.	Haiti.
The Commonwealth of Australia.	Hungary.
Brazil.	India.
Belgium.	Peru.
The United Kingdom of Great Britain and Northern Ireland.	The Netherlands.
	Poland.
China.	Portugal.
The Republic of Cuba.	Jugoslavia.
Czechoslovakia.	The Dominican Republic.
The Union of Soviet Socialist Republics.	France.
The United States of America.	Germany.

The most salient features of the agreement are as follows:—

In the preamble, the contracting parties declare that the agreement has been reached with a view to establishing and maintaining an orderly relationship between the supply and demand for sugar in the world market; they call attention to the fact that the present situation of the sugar market renders it possible and necessary for the Governments concerned to collaborate to this end; and they declare that they have borne in mind the principle that any International Agreement for the regulation of production and marketing should be equitable both to producers and consumers.

The agreement defines the quota year as the period from the 1st September to the 31st August, and lays down that the contracting Governments shall take all the legislative or administrative measures necessary for the execution of the agreement. Indications are given regarding the rules which it would be desirable to apply to agrarian policy and to State assistance to the sugar industry. It is agreed that favourable consideration should be given to all proposals having for their objective the reduction of the disproportion of fiscal burdens on sugar; the encouragement of increased consumption of sugar; the checking of abuses resulting from the substitution of certain substances for sugar, and the search for new uses for sugar. It is provided that a Council, which it is proposed should be formed, shall make a study of these various subjects and that the Governments shall supply certain statistics and information requested by the Council.

Chapter III contains the obligations entered into by countries not exporting to the free market, *i.e.*, a place where sugar may be sold in open competition. The United States of America will continue to import from the free market at least as much as at present. The Philippines will not export to the free market, so long as their present arrangement with the United States remains in force, except that a small share in any increase in the free market requirements is reserved fro them.

The United Kingdom will maintain its present legislation regulating sugar production designed to limit the annual production of sugar in Great Britain

to a standard quantity of 560,000 long tons of white sugar (approximately 618,000 metric tons raw value). It is expected, however, that for the sugar year 1937–38 this maximum will not be reached.

The British Colonies will limit their total exports to a basic figure of 965,254 metric tons (950,000 long tons) per quota year.

Australia will limit her exports to 406,423 metric tons (400,000 long tons). The Union of South Africa will limit them to 209,000 metric tons (230,000 short tons). India will prohibit exports by sea elsewhere than to Burma.

If consumption increases in the parts of the British Empire which are at present importers, the British Dominions and Colonies and the United Kingdom producers shall obtain a share in this increase proportionate to that which they have in present requirements, any surplus in such increase to be reserved for exporters to the free market. Australia and the Union of South Africa have undertaken to leave their share of the increases available to the free market in 1937–38.

The Government of China will use its best endeavours to the end that the sugar import requirements of the Chinese market shall not decrease, and if possible shall increase, during the period of the present Agreement.

The Netherlands undertake not to export to the free market sugar produced on their territory whether in Europe or in Dutch Guiana.

Chapter IV fixes the export quotas for the free market allotted to the difierent contracting countries. These basic quotas are as follows:—

	Metric tons.
Belgium (including Belgian Congo)	20,000
Brazil	60,000
Cuba	940,000
Czechoslovakia	250,000
Dominican Republic	400,000
Germany	120,000
Haiti	32,500
Hungary	40,000
Netherlands (including overseas territories)	1,050,000
Portugal (including overseas possessions)	30,000
Peru	330,00
Poland	120,000
Union of Soviet Socialist Republics (excluding exports to Mongolia, Tanna Tuva and Sin-Kiang)	230,000

Czechoslovakia will receive the following extra allotments for the year beginning September: 1937, 90,000 metric tons; 1938, 60,000 metric tons; 1939, 25,000 metric tons.

An export quota of 47,500 tons is placed in reserve, to be placed at the disposal of certain countries should need arise.

Jugoslavia shall have a claim on the reserve up to 10,000 tons during each year of the Agreement. France will be entitled to the remainder if her home or Colonial production exceeds her consumption.

Further, it is noted that the Governments of certain countries have given notice that during the quota year beginning September,1st 1937, they will not make use of certain parts of their export quotas, viz:—Belgium, 5,000 tons; Germany, 70,000 tons; Hungary, 20,000 tons; Poland, 20,000 tons; Union of Soviet Socialist Republics, 11,500 tons.

The French Government has, moreover, given notice that during the said year the reserve quota may be reduced by 22,500 metric tons.

In addition, in the years 1937–38 and 1938–39, the International Sugar

Council may reduce all the effective quotas as set out above by a uniform per centage not exceeding 5 per cent. if it thinks it necessary. Reductions may be made in later years if all the Governments concerned agree. On the other hand, if the quotas are inadequate at any time the Council may (acting by three-fifths majority) allot additional quotas pro rata to any extent it thinks fit. Provision is made for the Executive Committee to consider as a matter of urgency and consult the Council by telegraph if any sudden shortage or threat of an undue rise in price should occur.

Chapter V contains the provisions relating to stocks which have taken into account considerations of two kinds; on the one hand the contracting Governments have fully realised that due regard must be had to the necessity of maintaining adequate reserve supplies to meet unexpected demands and on the other they have agreed that it is undesirable that excessive stocks of sugar should be allowed to accumulate and weigh on the market. Those contracting Governments, to which export quotas have been or may be allotted, have undertaken so to regulate their production that their stocks shall not exceed respectively, on a date to be fixed each year by mutual agreement, an amount equal to 25 per cent. of their annual production. Nevertheless, the Council may authorise certain exceptions and moreover, special provisions have been made with regard to the stocks of the Republic of Cuba, the Netherlands, East Indies and Hungary. It is agreed that sugar production shall be regulated on the territory of cane-producing countries, apart from special adverse conditions, so that stocks shall equal on a fixed date in each year, an amount not less than 10 per cent of the export quota.

Chapter VI provides that the Agreement shall be under the administration of an International Sugar Council composed of representatives of all Contracting Governments, and by an Executive Committee of nine members. The seat of the Council and the Committee will be in London; a Secretariat will also be set up.

This chapter also lays down the powers and duties of these various organisations, indicates the conditions under which they will be summoned and budgeting arrangements, voting arrangements, &c. It is further provided that the Executive Committee shall include three representatives of the Importing Countries, three of cane-producing countries and three of beet-growing countries. The complete composition of this Committee is also determined.

Finally, Chapter VII contains various provisions particularly regarding the territories to which the Agreement shall apply, procedure in cases of infringement, procedure for cases in which the attainment of its object is being hindered by countries not parties thereto, conditions of ratification entry into force, duration (five years from the date of entry into force) denunciation and withdrawal in specified conditions.

The following communiqué, giving particulars of increases in the Colonial sugar quotas for 1937–38, was released for publication by the Colonial Office on June 18th.

For purposes of comparison we have placed the peak exports and basic quotas, as originally proposed, alongside the revised figures.

1. The Secretary of State for the Colonies, after full consideration of the various representations made to him, has decided the allocation of sugar quotas for 1937–38, on the unanimous recommendation of the Permanent Advisory Committee of Colonial Sugar Producers.

2. The basic quota for the Colonial Empire is 950,000 long tons. Over and above this figure the Colonial Empire is entitled to a proportionate

share of any increase in Empire consumption in 1937-38 over that in the current year. Further, the United Kingdom has agreed that its own proportionate share of such increase may, for 1937-38, be enjoyed by the Colonial Empire. For present purposes, the increase has been estimated at 3 per cent. which, with the inclusion of the United Kingdom's share, results in an addition of 47,000 tons to the Colonial Quota thus making a total of 997,000 tons available. The figure of 47,000 must be regarded as provisional pending compliance with the formalities set out in Article 14 (*b*) of the International Agreement.

3. With the exception of the three East African territories, Kenya, Uganda and Tanganyika, in regard to which a somewhat different basis was adopted, each Dependency was allocated to begin with its previous maximum exports up to and including 1936, less 7 per cent. The total of the quotas so allotted was 948,326 tons. The recommendation of the Committee was that the balance should be allocated among all the Dependencies other than the East African territories roughly on a basis of three-fifths pro rata and two-fifths to meet special cases. In considering the special cases the Committee took into account the whole social and economic position of each Dependency.

4. The recommendation of the Committee was that the quotas for 1937-38 (in tons of 2,240 lb) should be as follows:—

	Quotas for 1937–38.	Peak Exports.	Proposed Basic Quota.
Barbados.	114,000	119,685	111,307
British Guiana.. ..	170,000	176,500	164,145
Fiji	135,000	140,864	131,004
Jamaica..	86,000	77,733	72,292
Leeward Islands ..	53,500	49,670	46,193
Mauritius	263,000	274,783	255,548
Trinidad	138,000	142,671	132,684
Windward Islands ..	10,500	8,781	8,167
East Africa	27,000	29,017	26,986
	997,000	1,019,704	948,326

5. The Committee added a rider to their recommendation that British Guiana and Fiji should have a prior claim to consideration if any other Colony is unable to fill its quota.

6. The Secretary of State for the Colonies has considered the recommendation most carefully and has decided to accept it without modification. He fully appreciates that individual Dependencies may have hoped that the quota allocated to them individually would be larger; but he is satisfied that due weight has been given to all the various factors involved and to the representations which have been made to him and that the allocation is as fair as possible. It will be understood that quotas are only applicable to 1937-38 and that those for following years will be a matter for further consideration.

7. The question how the quotas for each Colony are to be divided among individual producers is left for local decision but it is presumed that the basis will be past production with whatever allowances may be necessary to meet recent developments. The Secretary of State considers it important that so far as possible special consideration should be given to the position of small cane-farmers.

8. As stated, a somewhat different basis has been adopted in calculating the quota of the East African territories. This was necessitated by the

special circumstances affecting them. The quota of 27,000 tons allotted to them will assure the group an increase of about 50 per cent. over its previous maximum exports. The division of the quota between the three territories, Kenya, Uganda and Tanganyika is to be left in the first instance to East Africa itself and the precise position of the individual territories cannot therefore at present be stated.

It will be noted that Antigua and St. Kitts; St. Lucia and St. Vincent; Kenya, Uganda and Tangayinka, are treated as single units as the Leeward Islands, the Windward Islands and East Africa respectively.

GENERAL NOTES.

WAIDOI GRASS (*Ischæmum aristatum* Linn.).

Travellers on the recently opened Navua road may have noticed the thick mat of straggling grass which occurs almost as a pure stand among the rubber trees in the old Waidoi plantation. This grass has always intrigued the writer who first observed it many years ago when visiting Waidoi. Identification of a plant without the presence of the flowering head is a difficult matter and, until this year, visits to the plantation never coincided with the flowering of the plant, and in fact, it was thought that the grass was numbered amongst the few species which do not flower.

On 25th June this year, on passing through the plantation, the grass was noticed to be flowering. Specimens of the flowering head were taken and brought back to the office where they were identified as *Ischæmum aristatum* Linn.

The grass is interesting in that for many years it has withstood the invasion of other plants and grasses and in this respect one would expcet it to be a promising grass from a grazier's point of view. In its habit of growth it somewhat resembles Para grass but the writer is of opinion that the grass is not as good either in palatability or nutritive quality as Para grass, and it is therefore not recommended to be sown in preference to the latter grass.

MARAINA GRASS.

Several enquiries have been received by the Department of Agriculture from country residents requesting information as to the identity and habit of the grass known to the Indian residents as Maraina grass. The grass has been identified as *Ischæmum rugosum*, Salisb., and is cited as one of the three major weeds of rice fields in Ceylon. It is tropical in its distribution. In Fiji it is a common pest of wet land rice-growing areas of the Lower Rewa River, Viti Levu and the mouth of the Dreketi River, Vanua Levu. Its eradication should receive the early consideration and attention of all rice-growers.

The grass in its young state is in general appearance identical with young seedling rice and is readily mistaken for it, hence one of the great difficulties in securing early and rapid eradication lies in this resemblance. Further, its seeding time usually concides with the harvest time of rice so that unless the paddy is carefully and thoroughly cleaned, resowing takes place each season when preparing and sowing the nursery beds. The following suggestions are made to assist in affecting control over this seed of wet rice fields. Generally it may be said that the area of rice grown by each Indian is small

and thus allows for a more intensive cultivation and attention of the crop during its period of growth, and, since the grass favours wet land, hand-pulling of it is easy.

The general custom of neglecting the ploughing after preparation of such rice land until a month or two before the next planting season gives the "Maraina" seed opportunities for germination, growth and possible re-seeding of the land before planting time.

Control may therefore be possible along the following lines:—

1. By burning all refuse as soon as possible after harvest and by ploughing. The burning would tend to destroy seed left in the rice straw, would hasten germination of seed lightly burnt and the ploughing would, if carried out as deep as possible, bury the seed and destroy it.

The next ploughing would be carried out at the usual preparation time or sooner, as circumstances indicated, to prevent the seeding of any grass which may have germinated and grown in the interval between ploughing.

When preparation is completed, careful hand-weeding should be carried out before planting commences, this would control both volunteer rice as well as Maraina grass.

Careful weeding a week or two after planting should rid the crop of most of the weed; and identification should be easy for the reason that it is customary to cut back the new planted rice to about 6 inches, the cut leaves persisting to identify the rice as against the grass subsequent weedings.

2. All paddy should be carefully winnowed to remove all foreign matter and seeds. Such careful screening would obviate the resowing of Maraina when preparing the sowing of the rice nursery bed.

3. Ensure that only pure paddy seed is used.

4. If the rice field is divided into four sections and a section planted at monthly intervals, (each section being carefully weeded both before and after preparation and planting), the weed should be brought under control, particularly as the planting season, which extends roughly from October to March, covers the normal germination and seeding time of Maraina. Finally, it should be remembered that a good farmer is a clean farmer and land which is well cultivated and tended usually has all weeds under control.

—C.R.T.

THE DWARF COCONUT.

The Malayan dwarf palm has been successfully grown in Taveuni by Mr. E. Duncan, who recently broadcast his opinions by courtesy of the local Wireless Broadcasting Station.

Mr. Duncan's opinions are substantiated by his actual results and by the writer's personal experience in Malaya.

The Malayan dwarf coconut occurs as three types, differing in the coloration of the midribs of the leaves of the young shoots, and of the rind of the ripening fruit.

Malayan experience indicates that of the three types green, red and yellow, the green dwarf is the most robust in growth, most resistant to adverse conditions, productive of the best quality copra and of the largest nuts.

On the whole, the dwarf palm is not so hardy as the tall palm as regards changes in soil conditions, &c., but the green type has proved eminently satisfactory under ordinary plantation conditions and is definitely superior to the red yellow types in its copra-producing characters, and on the average it produces the larger nut and is thus preferable for handling.

As regards the commercial characters of the dwarf coconut with the ordinary tall types, Mr. E. Duncan's experience confirms Malayan experience, that

under good average conditions the yields of copra per acre from dwarf coconuts exceeds those from the ordinary tall types.

The reason for this is due to the density of planting, since under local conditions, up to 133 dwarf palms may be planted per acre according to conditions, as against 50 to 80 of the ordinary tall palms. A planting distance of 18 feet by 18 feet is recommended for dwarfs in this Colony, giving 133 palms per acre, if square planting is adopted.

This planting distance, under existing conditions where soils are rich, where implemental cultivation is rarely possible, and where weed growth is prolific, should quickly keep weed growth in check and enable the palms to begin bearing after three years compared with 5 to 6 years for talls. The dwarfs should be in full bearing after 6 years as against 12 years for talls and approximately 6,000 dwarf nuts produce one ton of copra under Taveuni conditions where also yields per acre have exceeded this figure.

SOYA BEAN.

The chief competitors of coconut oil in the warld's markets are soya bean oil, palm oil, whale oil, cotton seed oil, linseed oil, groundnut oil, lard and tallow. There are also a number of less important oils such as maize oil which has shown considerable development in United States of America where 80,000 bushels of maize were used for this purpose in 1934.

The main use of most of the above oils include margarine, lard substitutes, edible and cooking oils, soaps, glycerine, paints, varnish, &c.

The growth of the soya bean industry is illustrated by production in United States of America where production increased from 160,000 tons in 1926 to over 500,000 tons in 1933 and imports into England and Europe generally have greatly expanded since 1930. In 1936, the world production of soya bean amounted to 10,332,000 tons.

Soya bean oil, as a result of new processes, is now a direct competitor with coconut oil. Similarly other oils, previously considered unsuitable for margarine or other purposes, can now be substituted for coconut oil as a result of advances in chemical treatment including hydrogenation, hardening, neutralisation and deodorization.

Hence, it is now possible to substitute one oil for another in manufacturing processes and thus manufacturers can quickly take advantage of price changes in their favour to adopt the cheaper oils to their immediate needs.

Thus coconut oil has now many more competitors than it had 15 20 years ago and therefore it behoves all producers to seek every possible means of affecting economies in their costs of production and marketing and of striving to gain the best prices by producing an improved product and by co-operation in marketing.

FORESTRY OFFICER.

At a recent meeting of the Legislative Council it was agreed that a fully-trained Forest Officer with several years of experience should be seconded to Fiji from Malaya in order to inaugurate forest work in this Colony. This is a sound progressive step and once practical field work is properly organised by a full time Forest Officer it should then be possible for continuity of effort to be assured by gradually building up the requisite staff.

The value of our forests is considerable but their value can be greatly enhanced by a progressive and continuous programme of sylviculture and protection of selected areas.

Hence the recommendations of the Legislative Council in this matter is hailed with satisfaction.

—H.W.J.

CULTIVATION OF BETEL LEAF IN FIJI.

By
SILAS RAM JAN, Indian Field Assistant, Western Division.

THE Leaf of the Betel vine (*Piper betle*) called " Pan " in Hindi, is used fairly commonly as a masticatory among some sections of the Indian community in Fiji. It is in the nature of a delicacy and is habit-forming. Commonly the fresh leaf is sprinkled with lime, a small piece of Betel-nut (*Areca catechu*) is added together with such other spices as suit the taste of the addict. Such spices impart an additional flavour and usually are one or more of the following:—Cloves, nutmeg, cardamom, tobacco or cinnamon. Regular use stains the lips, teeth and gums a bright red.

The Madrasees and Gujratis commonly chew betel or " Pan " in India and it is adopted to a certain extent in Fiji where it is customary to present " Pan " as a form of light refreshment to important personage or to visitors to the house.

The vendor of " Pan " is called " Tamboli."

It is used in the Indian marriage ceremony. The " Pan " is prepared by the bride and is given by her mother to the bridegroom as a token that each will share the other's troubles and hardships and that they will not be separated while they both live.

The successful cultivation of the plant requires much care and attention. It must be protected from excessive sun, wind and rain and is therefore usually grown under " green house " conditions. Considerable work is entailed in its production and the writer knows of four farmers who make a living from not more than two square chains of the vine.

A deep rich porous soil is required. Large quantities of well-rotted compost are dug in and thoroughly mixed with the soil. The plot should be properly drained so that the moisture can move freely. It is important that the right amount of water is available as either too much or too little will prevent the vigorous growth of the plant which is so desirable.

Planting material consists of cuttings which are planted 6 to 8 inches apart and are allowed to grow and cover the ground. Staking of the vines would probably produce better results but it is not commonly practiced here, though it is in the East.

In Fiji the " green house " covering the " betel " garden is built of coconut leaves, the top and sides being covered in. The plants are usually 4 months old before picking commences but thereafter pickings can be made weekly. When the top leaf is 4 to 4½ inches long the second and third leaves are also ready. The leaves are plucked and tied into small bundles of about two dozen leaves. These bundles are sold in the bazaars at three pence each and in Indian centres prove a profitable side line for the small agriculturist.

THE SHOW.

THE thirteenth Annual Show conducted by the Fiji Show Association was held in Number 1 and the Produce Inspection sheds on the 4th October.

In spite of showery weather the show was a decided success and attracted a larger number of visitors than in the previous year.

As in past years the Department of Agriculture put up a comprehensive exhibit, the chief features being a display of vegetables, including cauliflowers produced on Kadavu, rhubarb, turnips, leeks, carrots, lettuce, &c., and a standard type of small copra drier. An exhibit of cotton, seed cotton, cotton seed and lint baled for export attracted attention to a non-perishable crop suitable for cultivation by small holders which is gradually taking its place in the agricultural production of the Colony.

Other exhibits included tobacco, maize, soya beans, broom millet and brooms made locally therefrom, ginger, hemp, rice and a display of ornamental and economic plants.

The Veterinary Division exhibited specimens of pasture plants of Fiji, specimens of pathological conditions occurring in animals and samples of concentrate feeding stuffs. Charts illustrating the progress of tuberculosis eradication and the development of the dairy industry set out clearly the position in relation to these subjects. In the poultry section a house and run suitable for raising chickens was demonstrated.

The exhibits in the Division of Entomology were primarily designed to show the beneficial insects intoduced into the Colony from 1913 till the present year. A large scale map showed the countries from which the parasites originated, Java being seen to be the most exploited territory. Two examples of biological control in operation were on view, viz., the Mexician plant bug *Teleonemia*, introduced in 1928, shown feeding on the lantana plant and two Hymenopterous parasites of the fruit-flies: both of these were, like *Teleonemia*, imported from Hawaii though they originally came from India (*Dirhinus*) and Africa (*Tetrastichus*). These wasps attack respectively the pupæ and larvæ of fruit-flies (*Chætodacus*) and were seen ovipositing in their prey which were feeding on guava fruits.

The agricultural and vegetable competative sections provided an excellent display of produce.

Enteries were numerous in the class for kiln-dried copra prepared by Fijians in the standardised hot air driers and some very fine samples were seen. The Fijians again supported these sections by providing the bulk of the entries and one man, Rusiate Tuisopipi of Naimalavau, Nakelo, Tailevu, received prize money to the extent of £5 12s. 6d.

Mr. J. Barker provided a good display of vegetables and his entry was easily the best in that class.

Two Indian farmers entered in the class for the display of agricultural products grown by an Indian farmer.

Colo East and Macuata Provinces put up provincial agricultural and industrial exhibits and although the Colo East display, organised by Native Field Assistant Joni Roko, took the prize, the Macuata people are to be congratulated on their exhibit.

OBITUARY.

F. W. URICH, late Government Entomologist, Trinidad.

IT is with the deepest regret that we have read in recent West Indian papers of the passing of Mr. F. W. Urich, formerly Government Entomologist, Trinidad, and more recently, Assistant Professor of Entomology at the Imperial College of Tropical Agriculture. Although not directly connected with this Colony, the work of this scientist has been of particular value to Fiji, as it was due to his investigations, carried out at the request of the writer, which led to the discovery of the thrips which now bears his name (*Liothrips uricih*) and whose introduction into Fiji has been so successful in the control of the curse, *Clidemia hirta*.

It was also a note by this same officer, on the control of the transparent scale *Aspidiotus destructor* in Trinidad by certain ladybirds, which led to the equally successful introduction of *Cryptognatha nodiceps* into Fiji.

Mr. Urich was a keen all-round naturalist, interested in all forms of life and with a profound fund of local knowledge, which he always freely placed at the disposal of other workers. The writer has many pleasant memories of his kindly assistance and genial personality and his passing will be keenly felt by all those who have had the privilege to have been associated with him.

—H.W.S.

ABSTRACT.

THE MEAT AND LIVE STOCK INQUIRY COMMITTEE REPORT, KENYA (SUMMARY).

East African Agricultural Journal, Vol. III., No. 1., p. 21.

In settled areas, the general trend in farming is towards mixed farming instead of straight out crop-growing, due principally to the progress of the dairy industry. Dairying, however, is frequently carried out under ranching conditions, more suitable to beef raising than dairying but lack of beef markets, has forced the farmers into dairying.

Pig production has lagged behind the dairying industry. In 1922, there were 3·2 pigs for every 10 dairying cows, in 1934 the proportion was 1·87 pigs to 10 dairy cows, also little or no use of small flocks of sheep has been made. Lack of export markets has in both instances retarded the development of the industry.

Lack of adequate markets for slaughter also adversely affects the native reserves, an annual surplus of production over disposals results in overstocking with detriment both to the pastures and the stock themselves. Paradoxically, the situation appears to have been relieved by four years of drought and a severe epidemic of rinderpest. It is considered that many animals from such overstocked reserves will be fit for canning purposes only, but the removal of these lower grade animals would permit a general overhaul of grazing areas, the instigation of the quota system for different sections and the initiation of developmental scheme for the pastoral tribes.

Due to quarantine regulation against East African tropical diseases, the export of beef cattle on the hoof to neighbouring territories and the Mediterranean areas was impracticable.

Prospects of developing an export trade in canned beef and frozen or chilled beef were examined. It was considered that in the long run, any export trade must be based on beef with frozen pork, fat lambs, and poultry as sidelines. From investigation made in Southern Rhodesia, and advice received from representatives of a meat-exporting company, it was considered that a canning factory with a minimum capacity of 30,000 head had good prospects of success. It was further considered that there would be no difficulty in supplying 50,000 head for chilling or freezing. The committee considered that Kenya with its two rainy seasons was capable of maintaining beef cattle in condition throughout the year, a factor favourable to the production of chilled beef. It was thought that Kenya should aim at entering the highest class of the meat export trade, *i.e.*, the chilled meat trade of the London Market. It is the general opinion of authorities that certain areas are suitable for the production of chilled beef and many of the native breeds are of a suitable type for beef cattle.

The Committee considered that the maintenance of a small flock of sheep, on mixed farms was advisable as it assists in the retention of fertility of the soil and provides a profitable sideline.

Legislation for the control and development of the industry were recommended, with the establishment of a Meat Control Board. A suggestion was made that a levy on local sales of slaughter pigs be made, the accruing funds being used as a bounty for export sales.

In order to build up sufficient cattle, sheep and pigs of the requisite type to fulfil the demands of the expected trade, it was recommended that a sum of £3,000 annually be set aside for the purpose of providing assistance to farmers to purchase pure-bred stock, grants not to exceed half the cost of the animal at the purchaser's farm. For imported animals such grants should not exceed £50 for a bull, and £20 for a boar or ram. For locally purchased animals the maximum to be £25 and £5 respectively.

—H.M.S.

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